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Deserved Recognition

ENGINEERS are accustomed, after bearing the burdens of great undertakings, to take a back seat and let others get the credit. In connection with the Panama-Pacific Exposition, however, custom has been brushed aside and due recognition given to the fact that from its material side the Exposition is the engineer's work, carried to completion under his full administrative control. Even the architect reported to the engineer. His was the entire responsibility for the expenditure of the $17,000,000 put into buildings, roads, water supply, sewerage and the other essential works. The engineer management has been a success and it was graceful, indeed, on the part of the Exposition directors to show their appreciation publicly on Engineers' Day during the International Engineering Congress by presenting the heads of departments with commemorative plaques. It was a gratifying feature of a notable week.

San Francisco Knows How

IT is not possible to repeat the expression of appreciation regarding San Francisco's hospitality and energy, which were on the lips of every speaker at the closing session of the International Engineering Congress, without appearing, to those not present, to be extravagant. With the events of the week fresh in mind, the speakers attempted no restraint. They paid a deserved tribute to the wisdom and organizing ability of the committee of management; to the excellence and perfection of the Congress arrangements; to the thoroughly enjoyable social features; to that hearty hospitality which let no visitor want for anything as soon as his desires became known. Nor did the speakers pay less sincere tribute to the other evidences of San Franciscan ability and energy—the wonders of the Exposition and the Phoenix City which has risen from the ashes of nine years ago. Truly was there reason for deep feelings.

To Professor Durand, Mr. Cattell and those who labored with them, not only the visitors, but the profession at large, owe a large debt of gratitude, for, aside from the amenities of the Congress, there has been added to the world's store of engineering knowledge a large fund of accessible material. The various branches of the profession, too, have been brought closer together. Due recognition, too, should be given to the engineering organizations, the public service and industrial companies which co-operated with the management of the Congress. In the arrangement of the excursions and social affairs particularly their help, in men and in finances, was necessary to the complete success of the meeting. They gave of both without stint. Taken as a whole the Congress was a striking example of the team work and fearlessness that characterize San Francisco. To use an expression popular on the Coast, "San Francisco knows how."

Unity of Engineering

IS the time for closer co-operation among the National engineering societies at hand? One would certainly think so, judging by the significant remarks made at the International Engineering Congress. President Marx of the American Society of Civil Engineers at the banquet expressed the hope that a modus operandi would be found, while President Carty of the American Institute of Electrical Engineers made the first public announcement of the discussions which have been in progress when he said that he hoped for some tangible results. It will be remembered that the views of Secretary Hunt of the American Society of Civil Engineers, favoring closer co-operation, were reported in this journal several months ago. Certainly the time is ripe for action, for some method by which closer co-operation can be secured. There is co-operation now on the John Fritz Medal Board of Award and in the management of the engineering foundation, while there have recently been joint committees on several important subjects. The International Congress itself was a joint affair. The preliminary steps have, therefore, been taken. They demonstrate what joint action can accomplish, what influence can be wielded and what benefits derived when the resources of all the engineering societies are massed. General Sibert called attention to the unity of engineering and was greeted by enthusiastic applause. The discussions in progress are aimed at insuring, in practice, that unity which was so strikingly emphasized by the general.

City Planning and the Engineer

SEEMINGLY every phase of the big subject of city planning is covered in the valuable paper of Nelson P. Lewis presented at the International Engineering Congress last week, extracts from which appear in this and last week's issues of the Engineering Record. Special attention, however, is called to his last three paragraphs, setting forth why city planning is work for the engineer as well as for the architect, artist and social worker. The engineer is awaking to the fact that his field is something bigger and broader than surveying and the calculation of stresses. The business and administrative sides of engineering are coming to the front, as such addresses as that of Professor Newell on the civic responsibility of the engineer (see page 420) testify. The engineer's training and judgment are as much needed in determining what shall be built, and why, as in deciding just how to build it. And there is no more fruitful field for this broad-gage engineering, this matching of technical possibilities with civic needs and financial limitations, than city planning.

Deferred Maintenance

RAIL FAILURES are commonly attributed to flaws in the steel, defects which in the present state of the art are not to be avoided. Accidents caused by them are therefore to a large degree immune from criticism. In a rail-failure wreck recently reported on by H. W. Belnap, chief of the division of safety, Interstate Commerce Commission, the immediate cause is given, not as a flaw in the metal, but as defective track which resulted in undue stresses in the rail. Investigation showed that because of insufficient spiking and bracing an outside rail on a curve was forced outward, and that furthermore the far end moved the more rapidly and set up tension in the gage side of the rail, causing its rupture. This points to a dangerous condition in present-day railroad affairs. Opinions have come to this journal from several reliable sources that more than one road, in these times of meager dividends, is getting along with less than a safe minimum of maintenance. In this particular case further investigation would be needed to determine whether the poor track was due to the delinquency of one foreman or to the untoward economy of the road's management. The fact that a track walker went out over the track only once a week suggests a very small force trying to look after a very large section. And when one reads of an unspiked joint, and of 20 ft. of rail with only three holding spikes on the inside, this on a Middle West trunk line handling three passenger trains daily each way, one must conclude that somebody above the foreman took long chances. The road has only within a few years emerged from a receivership, and the times are not conducive to the rapid upbuilding of such a line. Neither, however, can it afford to neglect safety. If the condition is a common one on other roads the public and the regulators cannot wholly escape responsibility. Their persistent refusal to allow rates to keep pace with rising wages and prices for material has forced some companies to a point where the money for adequate maintenance is simply not to be had. Meanwhile Mr. Belnap has rendered a public service by his reminder that rail failures are not necessarily acts of God.

Graduate Engineering Courses the Solution for Overcrowded Curricula

ADDRESSING the International Engineering Congress on the subject of American engineering education, Prof. George F. Swain of Harvard University proposes a solution for the well-recognized overcrowding of 4-yr. courses. The administrators of engineering courses in this country would do well to ponder carefully his outline of many of the more serious difficulties and weaknesses which have affected the progress of engineering education, and which still exist in many institutions. The loss of training opportunities through use of the lecture system, the weakness due to "a smattering of many things," the substitution of mere-information courses for preparation-for-life courses, the subordination of the exceptional man to the average man, and the lack of thoroughness, initiative and reflective thought—all are given the emphasis which their importance requires.

This part of Professor Swain's address and his proposed remedy will be found in full on page 387 of this issue. He condemns the lengthening of the usual 4-yr. courses to 5 and 6 yr., or the requirement of college degrees for entrance to engineering courses, as adopted in some institutions, and proposes the lightening of the usual 4-yr. course at the top by the removal of highly specialized technical courses to the graduate school, to be given to those with the time, the money and the inclination or aptitude to profit most by them. This, of course, is exactly what Professor Swain has been doing at Harvard University for several years, and the results should speak for themselves.

With his contention for a standard 4-yr. course devoted to broad but thorough training in the fundamental principles of technical science, combined with short graduate courses highly specialized for the few, this journal is in complete accord. The short course leading to the bachelor degree should include such subjects as logic, philosophy, public speaking and English. The combined practical and theoretical courses offered at Cincinnati and Pittsburgh point the way to possibilities in the educational field, strenuous though they be for the student. If properly co-ordinated, with "humanity" courses included, they offer unlimited promise for uplifting the technical detail of engineering life by intimate contact with high conceptions of the significance of all human activity. Furthermore, practical instruction in the engineer's duty to the community in his civic relations is too often absent from our engineering courses, though so essential to the success of any educational process.

Whether Professor Swain's concluding statement that it is no longer necessary to go to European universities for higher technical training in engineering, and that American schools now offer better opportunities than are to be found anywhere in the world, be true depends largely on the degree to which our graduate schools actually accomplish their avowed object. Such a claim is directly affected by the present war in Europe, which will probably result in modifications in the content and spirit of the courses offered in foreign universities which cannot even be predicted.

Road Maintenance Cost Data

WITH the introduction of high-priced construction on country roads, together with the building of large systems of roads, there has come about an increased necessity and appreciation of maintenance cost data. To be of service, a clear understanding of the purpose the data ought to serve should be had and the charges to the maintenance accounts should be made in such a manner as will bring out the information desired.

Maintenance data, or data on the up-keep of country roads, are required by the officials in charge, first, that intelligent estimates of the funds that will be needed for the ensuing year may be made; second, that scientific comparisons may be made of various types of roads to ascertain which is most economical. It is evident that the data required for the former purpose will not necessarily give available information for the latter. To make a general estimate for the up-keep of a system of roads for the year does not necessitate any detailed analysis of the various factors, such as repairs to bridges, culverts, drains, gutters, shoulders, and the pavement proper.

Without attempting a comprehensive discussion as to how maintenance cost data should be secured and presented, there are two points which are of special importance and are frequently overlooked. First, there is often charged to maintenance what is really an addition to the capital investment in the road. This may be illustrated in the instance of a new culvert or a new guard rail other than was provided in the original construction. It is clear such expense is not, properly speaking, maintenance, but is in fact an addition to the capital investment.

It is equally an added investment in the road when a more expensive type of surface is employed to restore a worn out pavement of another type, although it is more difficult to state precisely just how much of the cost of the improvement in the latter case should be charged to the up-keep of the old surface, and how much is to be charged to capital investment. This amount would depend, in a given instance, on the extent to which the old surface had been worn. The longer it had been allowed to go without repairs, the greater would be the amount that would be necessary to restore it to its original condition; the greater, therefore, would be the charge against maintenance of the old type of surface, and the less would there be to charge to capital investment in the road due to the construction of a new type. But the maintenance costs reported on the State system of highways of New York arbitrarily, according to statutory provision, charge every expenditure following original construction to maintenance.

The second point, and one that adds greatly to the confusion in comparing reports on the maintenance costs of different types of road surface, is the inclusion of items for the up-keep of the shoulders, gutters, drainage system, and other portions of what may be termed the right of way, with that of the pavement surface proper. The cost of up-keep of right of way is practically independent of the type of the pavement. If, therefore, comparisons are to be made between types of pavement, only those data should be used which concern the surface of the pavement. All other maintenance work upon the road should be kept separate.

Until reports on maintenance costs are made so as to show separately the cost of up-keep of the pavement proper there is little value in such data to determine definitely as to the most economical type of road surface under given conditions, which is at present of the utmost importance.

Impressions of the Congress

THE Congress was a success. That is the principal impression to be recorded regarding the International Engineering Congress which closed in San Francisco last Saturday. That success lay, from the technical point of view, primarily in the opportunity afforded for discussing engineering topics. During the first three days oral discussion was meager. Beginning Thursday morning, however, the Congress seemed to take on new life and many meetings adjourned while the very first paper of the session was still under consideration. Particularly vigorous, interesting and valuable were the discussions on irrigation and hydroelectric development, subjects on which Western engineers are especially competent to speak. Eastern engineers attending these sessions must have gained a new conception of the meaning of water to these communities and of the possibilities and the problems the future holds forth for its more efficient use. Fortunately there was always a good sprinkling of Eastern members. It would have been well had the number been greater for, through Federal control, irrigation and hydroelectric development in the West will be stimulated or checked in accordance with Federal laws whose molding is effected by Nation-wide opinion.

The second impression of the Congress is one that holds a lesson for the future. Oral discussion would have been stimulated by a wider advance distribution of the papers. Failure to distribute copies broadly was the only adverse criticism of the Congress. That criticism, too, was always accompanied by comment on the wonders wrought by the management, and on the difficulty of making a judicious distribution where so large a membership was involved. It might have been feasible, however, to send a copy of the program to each member three weeks in advance of the meeting requesting him to indicate those papers which he desired to examine with the purpose of entering into the discussion.

The third impression relates to the opportunity afforded the individual for becoming acquainted with conditions in various parts of the country and of the world. Not the least of the returns for attendance lay in the visits with foreign delegates and with engineers from every part of our own country. There must have resulted therefrom a broadening in technical knowledge and of one's general horizon. Both foreign and local members seemed to appreciate the opportunity. Necessarily, too, the many new acquaintanceships formed with those who attended will not count as an insignificant feature of the meeting.

With the pleasures and benefits of the Congress fully in mind one cannot but echo the sentiment of one of the foreign delegates at the closing meeting—that international gatherings of engineers should be of more frequent occurrence. Certainly if international meetings cannot be held at shorter periods than in the past there is no reason why the National engineering societies cannot hold joint sessions annually or biennially.

Safety in Subway Construction

THAT the two recent serious accidents on the construction of New York City's new subways, in which sections of street decking collapsed, require investigation, fixing of responsibility and the fullest publicity is appreciated by no one more than by the engineers of the Public Service Commission. Because of the reckless disregard by motormen, truck drivers, chauffeurs and even pedestrians of the simplest warning signals in the vicinity of construction work, people who use New York City's streets have been in danger of just such accidents for many months. The reason for this recklessness seems to be a desire on the part of traffic to run by red flags in the hope of passing through the danger zone before the blast is fired. An editor of this journal was a passenger recently on a Seventh Avenue car which ran directly over a blast as it went off.

All the evidence now available seems to indicate that the official investigations will bring out the fact that the Seventh Avenue car which plunged into the subway cut Sept. 22 ran a block beyond the flagman, who first tried to stop it below Twenty-fourth Street, before it was finally brought to a halt. Had this car stopped when flagged the lives of its passengers would have been safe and it is also likely that the collapse of the street support would have been far less extensive.

The blasting foreman is said to have admitted that he ordered the shot fired with the car very close to the south end of the needlebeam. He had the choice of allowing the car to proceed, which would have encouraged others to disregard his flags, or of taking, as the history of subway construction shows, a chance of less than one in a thousand of endangering its safety. The motorman should have been compelled to back up, but construction flagmen have no authority to enforce orders of this kind or to bring to time those who disobey them. The police have such authority, but the police have troubles of their own, and, apparently, have not sufficiently explicit instructions on the subject to cause them to give these flagmen the support that must be given if the public is really to be safeguarded.

The Engineering Record believes the investigations will show that the type of street support employed by the U. S. Realty & Improvement Company is of ample strength when loaded in the manner intended. To be absolutely foolproof and safe even under accident conditions, however, it needs more X-bracing in vertical planes parallel to and at right angles to the street. Such bracing would probably have saved the collapse on Seventh Avenue, though it could hardly have minimized that on Broadway. It must be remembered that such bracing would have made both the street support and the construction work itself much more difficult and expensive, and, if required, would have caused a reversion to the all-timber street support generally used, a good example of which is described on page 439 of the Engineering Record of April 3, 1915. This type of support is not so strong under direct loading and does not make construction as economical as does the type used on the two damaged sections. It is, however, stiffer under accident conditions and somewhat less liable to total collapse.

If the public expects its engineers to guard it from all accidents, even when a large contributing cause is found in recklessness over which these engineers are given but slight control, its new subways must cost heavily in the shape of extra outlay for construction methods that are needlessly foolproof. The engineers and contractors are shouldering their share of the blame for both accidents. Let the public help by insisting on the observance of the rules provided for its own safety in construction zones where blasting is necessary.

The West's Water Powers

THE West has spoken on the disposition of its water powers, and its views, as set forth in the Western States water power conference at Portland, Ore., Sept. 20-23, will be considered radical except in the West. As reported in the news section of this issue the conference declared in favor of the relinquishment by the Federal government of all control over water powers on public lands. The control, the West believes, should be in the hands of the State government. Theoretically the position of the conference is correct. Under the doctrine of beneficial use, which governs the taking of all water in the Western States, ownership of the land does not give control of the water. The public lands, however, are made inviolate because the States do not possess the right of eminent domain over them.

Practically, however, the country at large will refuse to surrender the rights which public land ownership gives over Western water powers. In making its broader demands the conference was wasting its breath. Its time would have been better spent in the details under which private capital would be willing to develop power with Federal control. Condemnation of the Ferris bill was to have been expected and was fully deserved. Western water powers would not be developed under its provisions, for it not only gives too much arbitrary power to administrative officers of the Government, but is economically unsound in forbidding payment of appreciation and of development expense if the Government should take over the plant.

Between the extreme doctrines of entire surrender of control to the States and the Ferris bill, however, there is a middle course which, on the one hand, would safeguard the fundamental rights of the people and, on the other, encourage the development of the powers now going to waste. Such a measure would put the regulation of the power companies under the State public utility commissions and, as to relations between the company and the Federal government, set forth the terms definitely, not leaving matters to "the discretion of the Secretary of the Interior." The clauses covering these relations would then be simple. An irrevocable permit for a definite period must be provided, with recapture thereafter only on fair terms, allowing appreciation and development expenses. Holding powers for speculative purpose must be made impossible.

Compensation to the Government, theoretically, should be no more than a land rental, for that is all that the Government contributes to the enterprise. Where the power is developed for public sale such a rental compensation is entirely satisfactory, for the public utility commission, through rate regulation, will insure return to the public of its share in these valuable powers. On the other hand when powers are granted for the exclusive use of an industry, as they should be and must be, if the waste of power is to stop, land rental would not assure a fair return to the people and compensation depending on the horsepower developed is necessary. Manifestly the rate per horsepower would vary with conditions, but the figure set in the agreement should be unalterable for the irrevocable life of the franchise. For that reason, therefore, Congress should permit the compensation to be based either on land rental or on power developed. As to minutiæ—assignments of lease, liens, mortgages, combinations of power companies, etc.—they should be left to State regulation and to existing Federal statutes.

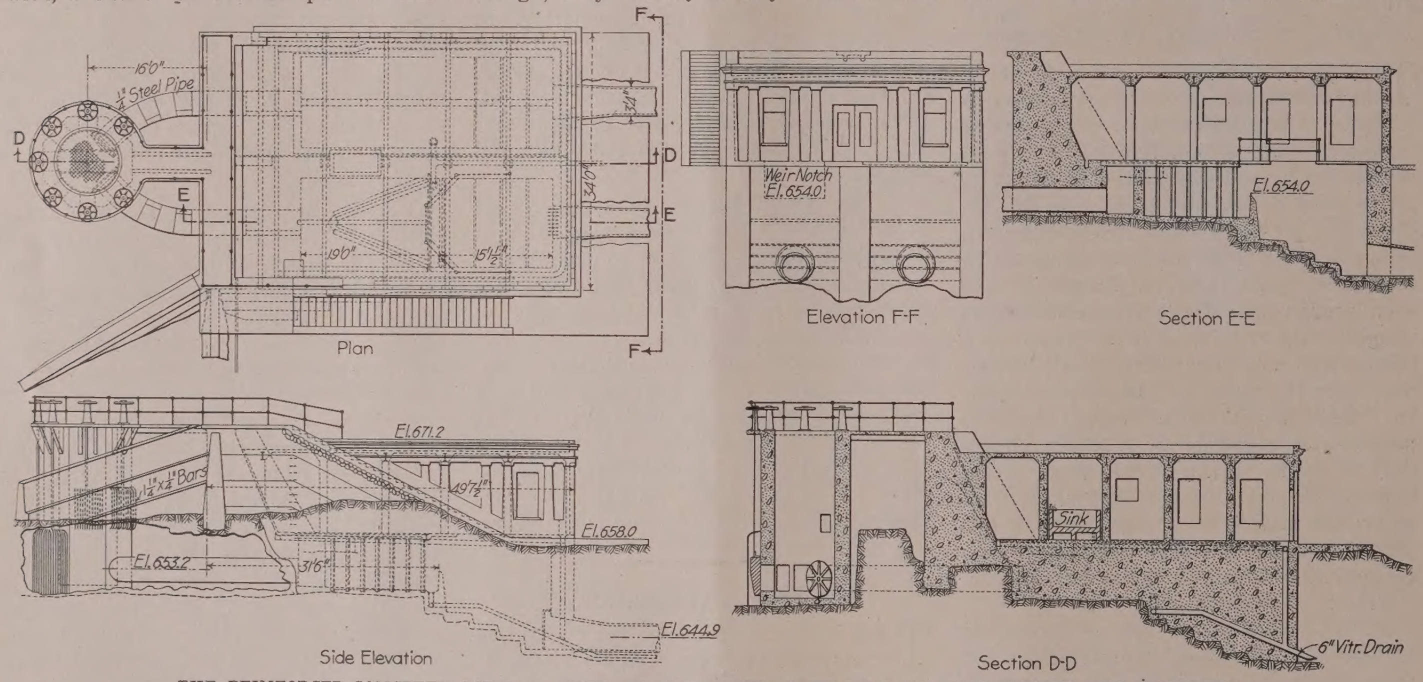
A sane power bill is badly needed. The waste of powers on the Pacific Coast is nothing short of criminal. It will continue so long as our Eastern representatives and senators feel that the Western States and their public utility commissions are monopoly-ridden. The West is, however, thoroughly capable of handling its affairs and securing for its people the full measure of benefit from the publicly controlled powers. It is to the interest of the country at large that the West be freed from its present water-power shackles. Action is imperative. The next Congress will do well to proceed along the lines indicated and not along those in the Ferris bill.

Costs and Special Features of the New Water Supply of Victoria, British Columbia

Inaccessible Mountain Country Imposed Severe Difficulties, Particularly in Conduit Design and Construction—Concrete Pipe Used for Flow Line and Steel Pipe for Pressure Line

By BOYD EHLE, M. Am. Soc. C. E.
Of the Sanderson & Porter Engineering Staff—Resident Engineer, Sooke Lake Water Supply System

THE EARLY PART of this year saw the completion of a new water supply system for the city of Victoria, B. C., the culmination of years of investigation and agitation for an increased supply. The general plan of the project and some details as to the construction of some of the features were described in the issues of the Engineering Record, Feb. 21, 1914, page 225, and Aug. 15, 1914, page 176. It remains now to give some attention to the costs and some of the details of special structures, and this will be done in a series of three articles. The first, presented herewith, will take up costs and special features of design on various structures. The other articles will discuss the construction of the concrete flow line and of the steel pressure line, projects of much difficulty owing to the virgin and mountainous character of the country.



THE REINFORCED-CONCRETE SCREEN HOUSE AT THE SOOKE LAKE DAM IS BOTH SIMPLE AND COMPACT

As set forth in the previous articles, the new supply is taken from Sooke Lake and is brought by means of a 37-mile pipe line to the city. The scheme involved the raising of the level of Sooke Lake 12 ft., the construction of a 42-in. concrete pipe on a slope of 1 in 1000 to an artificial lake known as the Humpback Reservoir, and then a 36-in. riveted steel line to the Smith's Hill reservoir, at the city. The supply provided has a capacity of 21,000,000 Imp. gal. per day.

There were nine tenders received for the construction of the system, with the usual wide variation in cost. On account of local sentiment, the work was let to a resident bidder, whose tender was $304,408 less than that of the next bidder, and $601,800 less than that of the average bid. The chief item of interest—the conduit from Sooke Lake to Humpback Reservoir—was offered at a price per linear foot of concrete pipe about as low as wood-stave pipe, and because of its permanent construction, it was decided to built the conduit from Sooke Lake to Humpback Reservoir as a concrete flow line.

Sooke Lake Reservoir

Sooke Lake, which acts as a gathering reservoir, lies 18 miles to the northwest of Victoria, at an elevation of 655 ft. above datum. It is about 4 miles long and ½ mile wide at its maximum, surrounded by rough, hilly country thickly forested with Douglas fir. Two narrows divide the lake into three parts, of which the upper and larger is 150 ft. deep in places. The watershed is approximately 30.1 square miles and this reservoir receives water from Fergusson Creek on the east side and a large spring and Whiskey Creek on the west side. The flow from these sources in the dry months of summer barely makes up for the evaporation from the lake surface. Sooke Lake watershed is adjacent to the Leech River watershed of 27 square miles, which will be used to supply water to the lake in the ultimate development, when a tunnel about 7 miles long will be driven from Wolf Creek direct to Humpback Reservoir.

The flow records, gaged on the weir of the concrete dam in 1914, show a total runoff of 64,353 acre-feet for a total annual rainfall of 57.53 in., giving a 70 per cent runoff. Table 1 gives the hydrographic data for Sooke Lake, while Table 2 gives the storage capacity at various elevations about normal lake surface.

Sooke Lake Dam and Control Works

The chief item of construction at Sooke Lake is the dam and control works. This dam is an ogee concrete masonry weir 175.5 ft. long, with a section of reservoir wall at the west side of the river, on the lower side of which a concrete screen house is built.

Table 2—Storage Capacity of Sooke Lake at Various Levels

Elev. in Ft.	Rise in Ft.	Storage, Acre-Ft.
667	12	12,840
670	a15	16,415
700	b45	64,000

a, with 3-ft. flashboards on dam; b, ultimate development.

Table 1—Hydrographic Data, Sooke Lake

Months	Inches Rainfall Per Month 1911	1912	1913	1914	In. Vaporation 1911	1912	Av. c.f.s. 1914	Acre Ft. 1914
January	....	7.47	9.66	16.79	....	0.00	336.5	20,650
February	....	7.48	3.89	3.85	....	0.00	100.0	5,540
March	....	1.89	5.16	4.19	....	0.27	120.0	7,370
April	....	0.68	2.00	2.04	....	1.07	7.5	446
May	....	1.59	1.60	1.28	....	2.85	13.5	600
June	....	2.05	2.98	1.77	....	3.31	9.5	57
July	....	0.62	1.59	0.05	....	3.03	0.0	00
August	....	4.62	0.81	0.40	....	1.45	0.0	00
September	0.24	1.91	0.90	3.26	1.05	1.10	0.0	00
October	1.70	5.74	4.85	10.07	0.60	0.53	72.6	4,460
November	10.37	12.99	16.55	11.70	0.08	0.02	331.5	19,740
December	7.72	12.77	3.57	1.95	....	0.00	89.5	5,490
Total	....	59.81	53.56	57.35	....	13.53	....	64,353

The remainder of the dam is an earth embankment with a concrete core wall. The total length of the dam is about 425 ft. over all. Above the dam and back of the screen house is the circular concrete intake tower, shown in one of the drawings, with seven sluice gates, to draw water from different levels. Three of the gates are 42 x 30 in. and four 24 x 30 in., caged against drift by iron slats on the upper side.

INTAKE TOWER

The intake tower was built of 1:3:6 concrete. The well, 8 ft. in diameter is covered with a paneled, checkered ¼-in. iron plate setting on an iron curb. The top slab of the tower is corbeled out to place the stands vertically over the gates.

From the well of the intake tower to the screen house are two 40-in, riveted steel inlet pipes. One of these outlets for future need is closed by a cover plate. The water from these pipes passes through two sets of screens—one 40-mesh and one 80-mesh per linear inch. These screens slide in channel-iron guides and are operated from the screen-house floor. The water passes over an 8-ft. sharp edged measuring weir, El. 654, and cascades down to the inlet of the concrete flow-line conduit with its axis at El. 645.0. A gage rod and a vertical floating vernier rod are used to measure the height of flow over the weir.

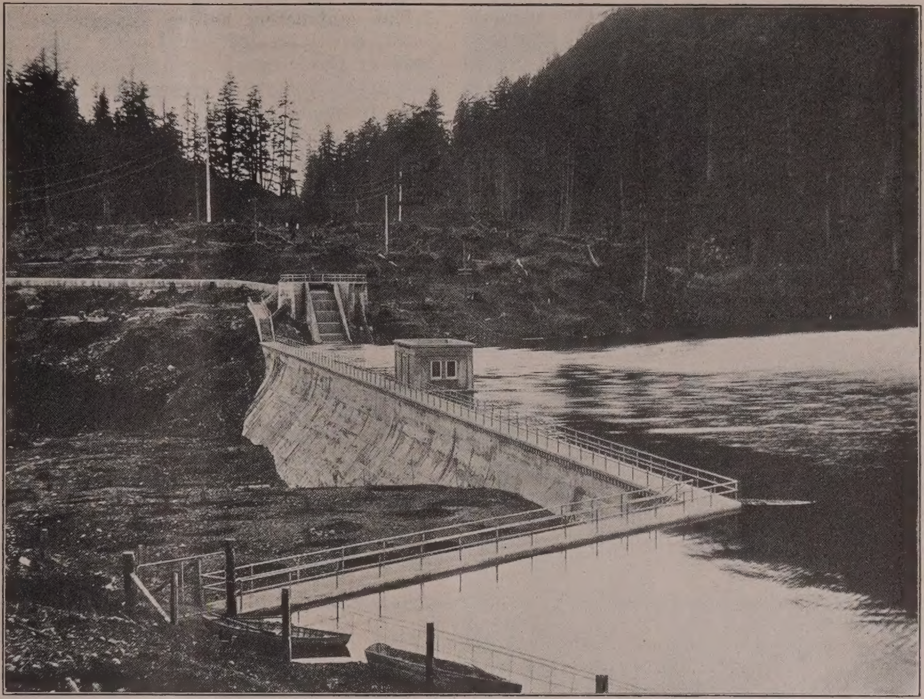
On the screen-house floor, adjacent to the screens, is a concrete sink, to which pressure water is piped from an elevated tank on the hillside at the west end of the dam. A never-failing spring supplies water to this tank. The caretaker washes the screens, laying them on this sink with the dirty side down and the jet of water quickly cleanses them.

CLEARING

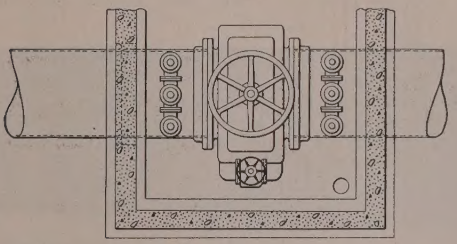
Around the shores of Sooke Lake it was necessary to cut and burn 296 acres of brush and timber in order to provide for raising the lake surface 15 ft.

This work was done after the usual logging methods in successive stages as follows: (a) Swamping and burning the brush; (b) falling trees and close cutting stumps; (c) bucking the timber; (d) rolling, piling and burning.

A steam donkey engine on skids was usually used to haul and pile the timber and stumps, using a tree for a mast to pile around its base. Dynamite was used, when necessary, to split up large timber and trees for hauling to piles. For pulling the sunken logs, the donkey engine was moved on a raft around the margin of the lake.



WATER ENTERS HUMPBACK RESERVOIR OVER CASCADE AT END OF DAM



DAM FOUNDATION

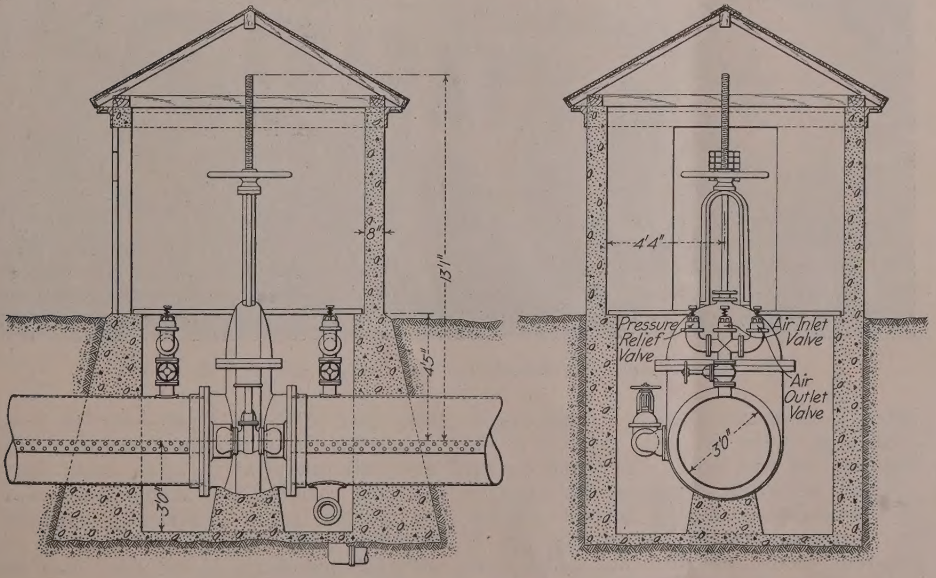
For the purposes of constructing the dam foundations and doing submerged clearing, a drainage channel was cut through the rock forming the stream channel to lower the low water lake surface 3 ft. The rock at the dam site is of a schistose character, loose and considerably weathered at the surface. The use of powder increased the difficulty of obtaining tight conditions for the dam, and it was necessary to pick out a large amount of the rock in order to get a firm foundation. Wheelbarrows on plank runways were used for disposing of the spoil along the river banks where it did not restrict the waterway.

On account of the isolated location of the dam site, transportation charges on the plant and cement were high for hauling from the railroad. There was a gravel deposit at the upper end of the lake and a quantity of dirty sand that was hopelessly bad for mortar. By cross-cutting one of the smaller valleys, Fergusson Creek, with prospect holes, a small deposit of sand was obtained.

WASHING SAND AND GRAVEL

It was necessary to instal washing plants at the site of the gravel and of the sand deposits, and some difficulties occurred in getting a passably clear product on account of the clay coating on the sand and gravel. A rotary-screen washer, driven by a gasoline engine, was used at the gravel deposit, with a perforated pipe, discharging inside on the gravel. At the sand deposit a gravity washer was installed, using water from a flume to Fergusson Creek, discharging under pressure through holes in the bottom of a box, by which the dirt was washed up and overboard. The product at each washer discharged by gravity on the deck of scows. There were two of these scows built on the lake. These were towed by a small tug having a 12-hp. gasoline engine.

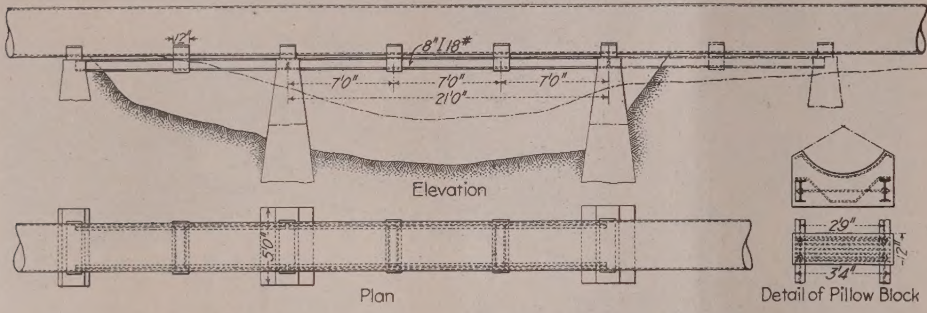
The sand and gravel was unloaded into buckets of an inclined cableway running over a storage pile. The cement was teamed in from the railroad and stored in warehouses at the dam site. The aggregate was wheeled to a ½-cu. yd. Ransome mixer, with loading attachment. The mixer discharged into buggies which dis-



STANDARD GATEHOUSE FOR 36-INCH VALVE ON STEEL PIPE LINE tributed the concrete from a trestle through chutes into the dam forms. For the high levels of the dam a builder's hoist was used for lifting the buggies to the top of the trestle. The form work, which was very simple, was braced back by struts to the ground. The dam was built with about 20 per cent of plums.

EMBANKMENT

The earth embankment at the end of the concrete dam was built up in 6-in. layers with scrapers, after the natural ground was thoroughly cleaned and plowed for binding. A light concrete core wall was built to prevent seepage. The 6-in. layers of the embankment were slightly dished toward this wall and compacted by wetting and ramming. The upstream slope was paved with hand-placed rubble from the foundation excavation.



THIS SIMPLE I-BEAM CROSSING OF DEADMAN'S RIVER IS TYPICAL

At the west end of the dam, overlooking it and the lake, was built a tasty, two-story log cottage for the caretaker.

TABLE 3—AVERAGE UNIT COSTS OF WORK AT SOOKE LAKE DAM

Clearing (296 *acres*)

	Per Acre
Swamping and burning	$65.60
Falling and close-cutting of stumps	29.60
Bucking, splitting, piling	75.60
Rolling, piling and burning, grubbing and pulling of rotten stumps	143.50
Miscellaneous	11.35
	$325.65

(Plant charge, maintenance and incidentals included.)

Earth Excavation, Sooke Dam (2054 *cu. yd.*)

	Per cu. yd.
Labor	$0.736
Material and plant charge	0.043
Camp charge	0.121
	$0.900

Rock Excavation, Sooke Dam (2907 *cu. yd.*)

	Per cu. yd.
Labor	$2.71
Plant and material	0.281
Camp	0.449
	$3.440

Sooke Dam

Foundation concrete (1:3:6) to rock line, 1176. cu. yd.	Per cu. yd.
Cement	$4.74
Sand	1.46
Gravel	2.27
Forms	1.07
Mixing and placing	1.90
Plant and tools	2.20
Supplies	0.74
Camp	1.31
	$15.69

Concrete (1:3:6) above rock line, in screen house, core walls, etc., 862 cu. yd.	Per cu. yd.
Cement	$4.64
Sand	1.32
Gravel	2.22
Forms	1.34
Mixing and Placing	1.94
Plant	0.49
Supplies	1.27
Cleaning up	0.57
Miscellaneous	0.29
Camp	1.74
	$15.82

The contractor, before abandoning the work, April 12, 1912, had done about one-half of the clearing around the lake and had nearly completed the excavation for the dam foundations. The remainder of the work was done by day labor under the engineer's direction.

The costs of the work at Sooke Lake are shown in Tables 3 and 3a.

CONCRETE FLOW LINE

When the use of wood-stave pressure conduit was found inadvisable, it was decided to build the reinforced-concrete pipe as a flow line, laid on an 8-ft. roadbed, excavated along the grade contour. The concrete line is 27.3 miles long, and, as before noted, is composed of 42-in. reinforced-concrete pipe of the lock-joint type. For the flow line, the wall is 3 in. thick, and for the siphons, of which there are six, with a maximum head of 90 ft., the walls are 4½ in. Drawings herewith show the type of concrete trestles, overflows and stand pipes used. Minor drainage crossings are cared for by 24-in. and 12-in. pipes.

TABLE 3a—WAGE SCALE ON SOOKE LAKE WORK

Eight-hour day; time and one-half for overtime

Foreman	$4.00—$5.00
Common labor	2.75
Head fallers in clearing	4.00
Second fallers in clearing	3.50
Buckers in clearing	3.50
Carpenters	4.25
Blacksmiths	4.00
Cooks (per month according to camp size)	$75.00—90.00
Flunkies (per month according to camp size)	$40.00—45.00
Bull cook	2.75
Hoisting engineer	4.00
Teams	$6.00—7.00

A survey party staked the field location by adjusting circular curves to fit the grade contour after the manner of irrigation canal location, using a minimum radius of 76.7 ft. and 3 deg. maximum chord angle. Table 4 shows the location curves that were used.

TABLE 4—LOCATION CURVES FOR CONCRETE PIPE LINE

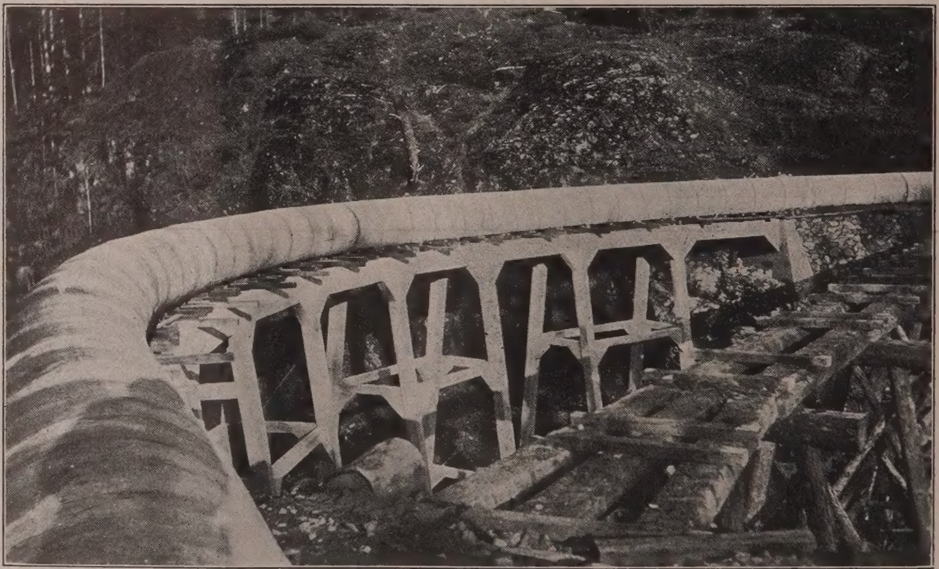
Degree.	Radius, ft.	Deflection angle.	T angle offset, ft.
75° 00'	76.737	9° 22½'	4.07
62° 30'	91.959	7° 49'	3.40
50° 00'	114.816	6° 15'	2.72
37° 30'	152.956	4° 41'	2.04
25° 00'	229.294	3° 07½'	1.36
18° 45'	305.70	2° 20½'	1.02
16° 40'	343.878	2° 05'	0.91
15° 00'	382.087	1° 52½'	0.82
12° 30'	458.421	1° 34'	0.68
10° 00'	573.131	1° 15'	0.55
8° 20'	687.76	1° 02½'	0.45
6° 15'	916.89	0° 47'	0.34
5° 00'	1146.26	0° 37½'	0.27
4° 10'	1374.76	0° 31'	0.23

Chord of 25-ft. length staked.

TESTS

The use of a 3-in. shell for pipe 42 in. in inside diameter at first seemed critical but the results proved that this was ample. The pipe was not backfilled, except for about 2000 ft. in a deep sliding cut, where 4½-in. shell pipe was used. A test of the 3-in. shell pipe, 4 ft. long, gave a crushing load of 1½ to 2 tons and a bursting pressure of 20 to 25 lb. per square inch, equal to a pressure head of 53 to 57 ft. The siphon was laid under hydraulic heads up to 90 ft. and a test of the conduit under working conditions shows practically no leakage.

The question of taking care of expansion effects on the pipe line caused some anxiety and the contractor at first installed some copper diaphragm expansion joints with no appreciable effect and they were discontinued. The engineers' idea was to let the cracks develop where they might and then take care of them if necessary, as it was impossible to predict their location. However, the cracks at the pipe joints laid in extreme variations of temperature caused no trouble, as the ballast, in connection with the reinforcement, prevented any considerable movement of the pipe. In a general way, it appeared that a hair-line crack



CONCRETE TRESTLES WERE ALSO USED FOR SOME OF THE CROSSINGS

TABLE 5—INTERNAL PRESSURE TESTS OF 42-IN. CONCRETE PIPE—TESTED TO DESTRUCTION

Kind of pipe.	No. tested.	Age in days.	Broke at lb. per sq. in.
3-in. shell, no reinforcing......	1	60	25
3-in. shell, standard gravity pipe	1	35	22
3-in. shell, standard gravity pipe	1	35	26
3-in. shell, standard gravity pipe	1	35	28
3-in. shell, standard gravity pipe	1	55	29
3-in. shell, standard gravity pipe	1	105	15
3-in. shell, double mesh gravity pipe	1	60	30
4½-in. shell, siphon pipe, 20-ft. head	1	60	45
4½-in. shell, siphon pipe, 40-ft. head	1	60	45
4½-in. shell, siphon pipe, 40-ft. head	1	60	60

All concrete 1:2:4 mix. Reinforcing for standard gravity pipe is No. 9 wire 4-in. centers; reinforcing for 20-ft. head siphon pipe is ¼-in. square twisted rod, 3½-in. centers; reinforcing for 40-ft. head siphon pipe is ⅜-in. square twisted rod, 3½-in. centers.

developed at about every fourth joint. These caused no trouble.

In order to give access to the pipe, manholes, covered by a screen and cap, were placed at both ends of the siphons and at each 2000 ft. of line. These limit the possible pressure head on the flow-line pipe to 2 ft. A 10-ft. overflow weir, 800 ft. below the Sooke Dam, with 1½-ft. freeboard, will control any excess water unwittingly turned into the conduit. All siphons have 6-in. steel nozzles and gate valves for emptying the conduit.

Caretakers will be on duty at each end of the conduit and will look after about 4 miles of line. Two patrol houses are built for the intermediate patrolmen who will each look after about 10 miles of line. A phone line was built along the conduit between the caretakers' houses and the reservoirs, with connections to the waterworks office in Victoria, the patrolmen's houses and various patrol boxes for effectively operating and maintaining the conduit.

Table 5 gives results of internal pressure tests on the pipe, and shows that the reinforcement in the 3-in. wall flow line was not necessary except for handling. Table 6 gives the coefficient n in Kutter's formula for various depths of flow. The difference of depth of flow in the pipe and the coefficient show the loss of water which was larger than normal before the pipe was finally tightened up.

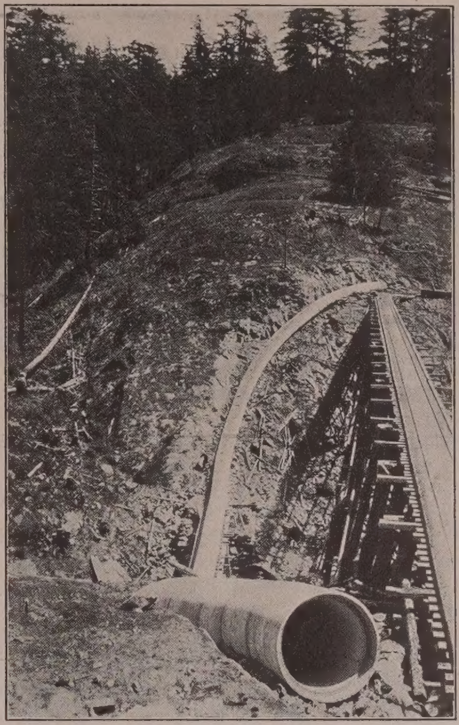
HUMPBACK RESERVOIR

The water from the conduit discharges into a concrete chamber under a perforated concrete baffle board cover to still the flow over the measuring weir. The water passes over an 8-ft. sharp-edged measuring weir down the cascade steps 20 ft. to the surface of Humpback Reservoir, at elevation 480 ft. The water can be discharged below the surface of the reservoir through a pipe with a submerged outlet to prevent churning to a milky appearance at short periods in the year when some minute vegetable growth is present. A third outlet pipe by-passes the reservoir and connects to the pressure conduits to the city service reservoir.

TABLE 6—COEFFICIENT n OF KUTTER'S FORMULA IN 42-IN. CONCRETE FLOW LINE FROM WEIR MEASUREMENTS

At Sooke Lake.		At Humpback Res.	
Depth of flow. in.	n	Depth of flow, in.	n
8⅝	0.01152	8	0.0121
14½	0.01185	13¾	0.01157
20	0.01175	19½	0.01142
26	0.01165	25	0.01125
Full	0.01058	36	0.0117

The reservoir site—about 40 acres—was cleared of all trees, brush and vegetable growth. The bottom peaty soil, after grubbing of the vegetable matter, was covered with a 6 to 8-in. layer of clean sand and gravel.



CONCRETE PIPE FOR FLOW LINE WAS USED UNDER MAXIMUM HEAD OF 90 FEET

The storage capacity of the reservoir is as follows:

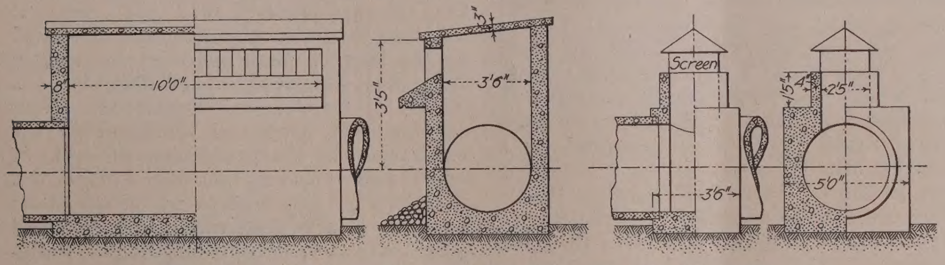
Elevation, ft.	Capacity, Imp. gal.
480	125,901,000
475	85,350,000
470	53,947,000
465	30,500,000
460	12,913,000
455 top of pipe taken as zero.	

The impounding dam is a reservoir section, built of concrete on trap rock foundation. Its length is about 675 ft. and maximum section about 60 ft. high. Details of the dam and of the construction cost will be found in the Engineering Record of Aug. 15, 1914, page 176.

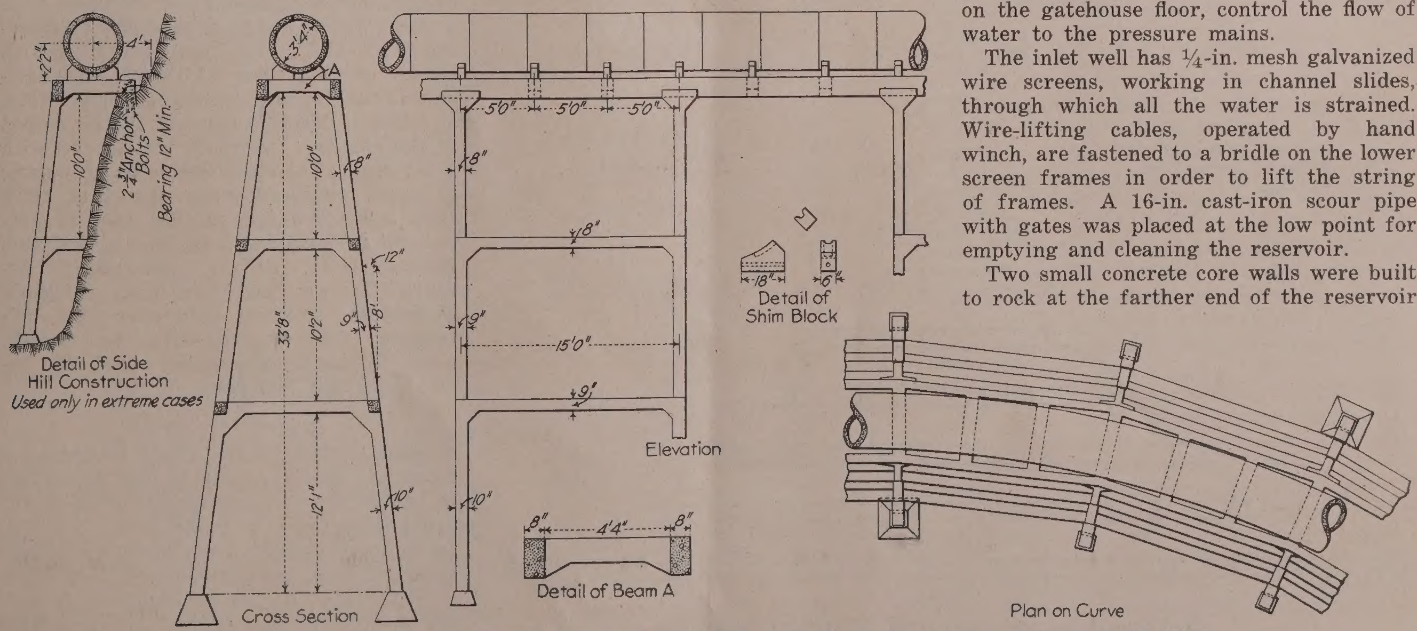
A concrete well and gate house was built near the middle of the dam with two outlet connections for the 36-in. pressure mains. Two low and two high-level inlet sluice gates, operated by stems to standards on the gatehouse floor, control the flow of water to the pressure mains.

The inlet well has ¼-in. mesh galvanized wire screens, working in channel slides, through which all the water is strained. Wire-lifting cables, operated by hand winch, are fastened to a bridle on the lower screen frames in order to lift the string of frames. A 16-in. cast-iron scour pipe with gates was placed at the low point for emptying and cleaning the reservoir.

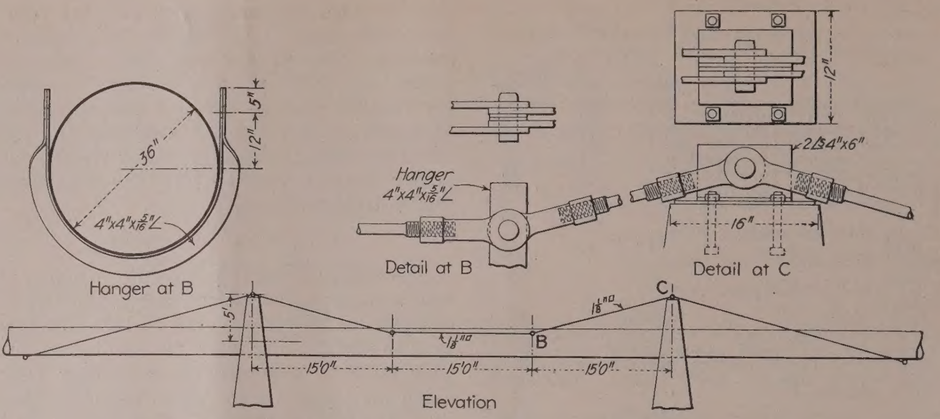
Two small concrete core walls were built to rock at the farther end of the reservoir



OVERFLOWS AND STANDPIPES WERE PROVIDED ON THE CONCRETE LINE



DETAILS OF TYPICAL CONCRETE TRESTLES USED FOR A HIGH CROSSING ON CONCRETE FLOW LINE



SUSPENSION SUPPORT USED AT MILL STREAM CROSSING OF STEEL LINE

to act as cut-off walls in gravelly soil that might leak.

Pressure Line

Water from Humpback Reservoir is delivered to Victoria through a 36-in. riveted steel pipe line, 56,677 ft. long, of which 20,137 ft. are of 5/16-in. and the remainder are 3/8-in. plates. Details of two drainage crossings, one a simple I-beam bridge, and the other a suspension bridge, are given herewith, as is also a drawing of one of the gatehouses.

In the same manner as in the concrete flow line certain definite location curves were adopted, being based upon the length of sheets used and economy in cutting them.

The minimum radius adopted was 31.5 ft. and the maximum chord angle, 3 deg. For straight sections a single length of pipe consisted of four 68-in. sheets, giving about a 22-ft. length. Each course is composed of one plate, bent to a complete circle, with double-riveted lap joints longitudinally and single-riveted lap joints circumferentially. In the 3/8-in. plates 3/4-in. rivets are used; in the 5/16-in. plates, 5/8-in. rivets. An accompanying drawing shows the layout of plates for curves of different radii, while the actual figures are given in Table 7. For the curve of minimum radius the plate was cut so that three pieces of pipe could be secured from one 68-in. sheet. All other layouts are made of straight or beveled plate of the 68-in. stock.

Table 7—Location Curves for 36--in. Riveted Steel Pipe

No.	Chord length ft.	Radius, ft.	Degree of curve	Chords
1	1.65	31.50	181° 49′	1/3 course
2	5.40	103.13	55° 33′	1 course
3	10.88	207.79	27° 34′	2 course
4	16.36	312.45	18° 20′	3 course
5	21.84	417.11	13° 44′	1 length
6	43.76	835.75	6° 52′	2 length
7	65.68	1254.43	4° 34′	3 length
8	87.60	1673.03	3° 25′	4 length
9	109.52	2091.67	2° 44′	5 length
10	131.44	2510.31	2° 17′	6 length

The pipe was tested for leakage between the sectionalizing gate valves outside of the city, but oftener along the streets, by using bumped heads, riveted in the ends of the pipe. The pressure was pumped up by an air pump to 200 lb. at the lowest elevation of the section tested and the leaks calked up until the loss of water was not greater than at the rate of 1 Imp. gal. per foot of pipe for 24 hr. The maximum pressure was held for at least 20 min. No considerable difficulty was experienced in meeting these requirements. The raw field work was carefully painted with bitumastic-enamel solution after the field riveting, and later, retouched at all points where the coating was injured by the recalking.

The drainage structures, gatehouses, Venturi meter house and manholes at all outlets were built by day labor.

All summits were provided with air outlet valves and air inlet valves near the steep grades to protect the pipe against collapse. Six-inch blowoff outlets, with gate valves, were placed at the bottom of all depressions for emptying the conduit. Air, inlet, outlet and pressure relief valves were placed on both sides of the sectionalizing gate valves. Brick manholes were used in the streets and rubble manholes in the country, with the city standard castings and covers. Two of the sectionalizing gates, lying on their sides, were placed in concrete vaults under the streets and three placed vertically in concrete gatehouses. All the water passing through the city is measured by a Venturi meter in a concrete vault adjoining the gatehouse, about 150 ft. below Humpback Dam. The recording and registering apparatus is placed in a room in the gatehouse.

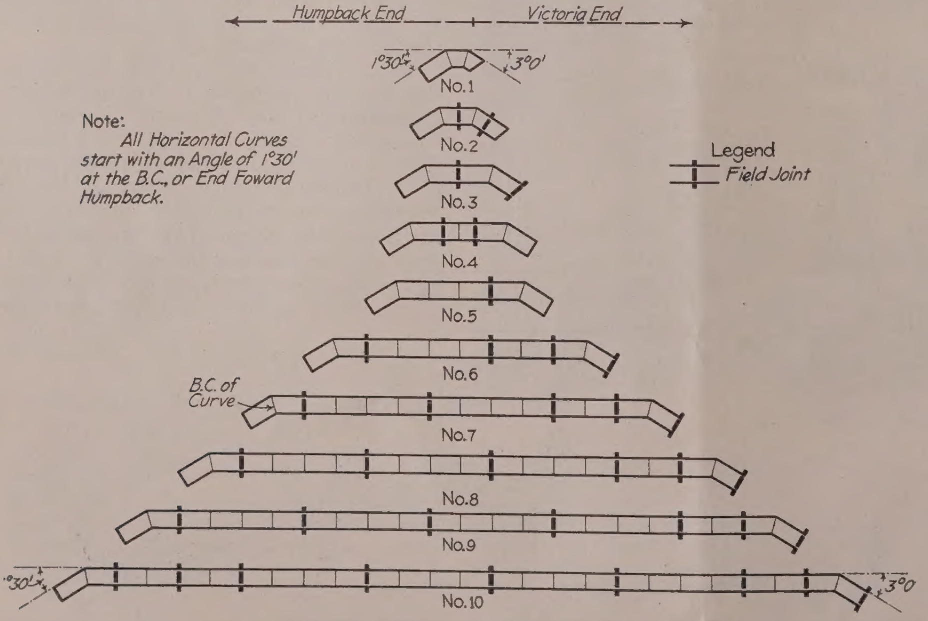


PLATE LAYOUTS FOR CURVES OF DIFFERENT RADII

Table 7 gives data as to chord lengths and radii.

In later articles details will be given as to the methods of constructing the concrete flow line and the steel pressure line. The articles will also contain costs of these features of the work.

After the failure of the original contractor the work was done by force account. C. H. Rust, M. Am. Soc. C. E., as city engineer and water commissioner of Victoria, had full charge of the work. Wynn Meredith, M. Am. Soc. C. E., a member of the firm of Sanderson & Porter, of New York and San Francisco, was consulting engineer, and the writer, resident engineer in charge.

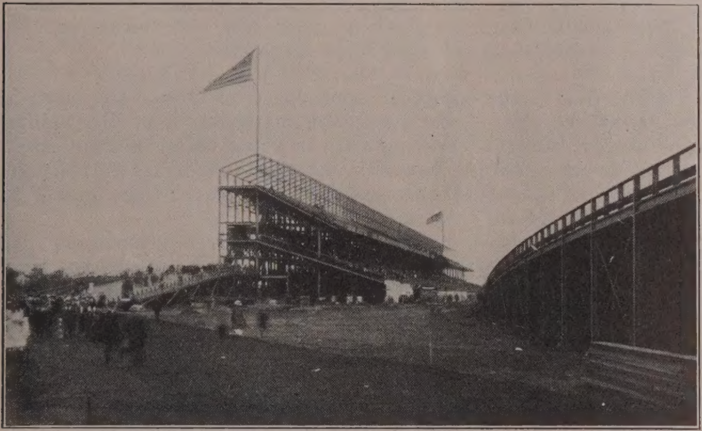
Stone Production in 1914 Less Than in 1913 or 1912

The production of stone in the United States in 1914 reached a grand total value of $77,412,292, according to the U. S. geological survey. This was slightly less than the production of 1912, and 7 per cent less than the production in 1913. Classified by the kind of stone quarried, the largest item was limestone, at $33,894,155, followed by granite, at $20,028,919. Next came marble, trap and sandstone in the order named, the production of each of which was valued at less than $10,000,000. Classified by the uses to which the stone was put, a large lead was held by crushed stone with a value of $30,161,766. Building stone and riprap fourth and fifth with $18,000,000, monumental stone third with a value of more than $7,000,000, and paving stone and riprap forth and fifth with values of less than $4,000,000. Pennsylvania, the leading stone-producing State, quarried in 1914 10 per cent of the output of the country. Vermont was second with 8 per cent. The other States which during the year produced stone valued at more than $2,000,000 are, in the order of output, New York, Ohio, California, Indiana, Massachusetts, Illinois, Wisconsin, Missouri, Georgia and Virginia. Virginia showed the greatest gain over 1913, advancing from twenty-fifth to twelfth place, displacing Tennessee, which fell below the $2,000,000 mark in 1914.

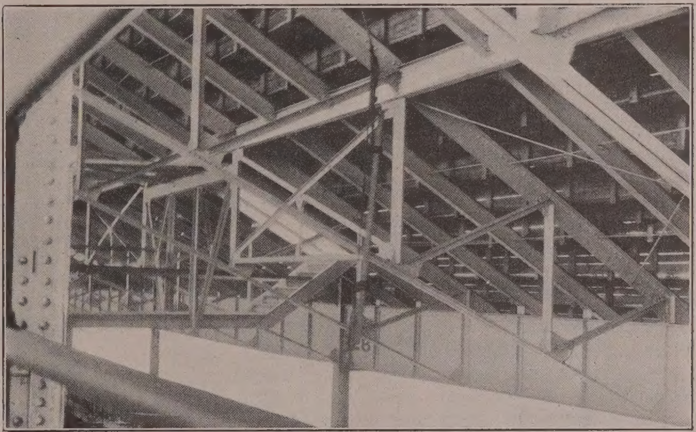
Irrigation of Sugar-Cane Lands as a means of partly offsetting the reductions in benefit due to free sugar is becoming of great importance in Porto Rico. The Fajardo Sugar Company has works under construction to irrigate 2000 acres of its lands at Fajardo, P. R., and contemplates extending them in the near future to irrigate 2000 acres more.

Grandstand at Sheepshead Bay Speedway, New York, Seats More than 30,000

Proposed Extension to Present Steel-Frame Structure Will Give Total Capacity of 45,000—Cantilever Trusses and Timber Floor



LEFT — RAMPWAY LEADS TO LOWER CONCOURSE—BANKED TRACK ON RIGHT



RIGHT — SECOND TIER TRUSSES, BEAMS AND BRACING FOR RUNWAY

PROVISION for more than 30,000 people has been made in the seating capacity of the grandstand at the new Sheepshead Bay Automobile Speedway, New York City, where to-day the Astor Cup race will take place on a track which already holds a world's 10-mile record, made Sept. 18. This steel grandstand, while not containing many unusual features, provides safe and numerous exits, is well braced and conservatively designed for loads and stresses prescribed in the New York building code, and is made of sufficient strength to allow future replacement of the timber flooring with concrete. Care was used in the design to insure that the lines of sight from all seats to any part of the track would be unobstructed.

While roof protection is not furnished for the inner parts of the lower tiers of seats, owing to added cost and interference with the view of proposed aeroplane races, the upper roof truss is so designed as to permit a future extension to cover a much greater proportion of the upper-tier seats. The wide concourses under cover would furnish protection in case of sudden storm. The 2-mile track, which is of unique construction and is the only one of its type in this country, was described in the Engineering Record of June 12, page 739. The present article will illustrate the main features of the grandstand. The bleachers, on the opposite side of the track, are of the usual timber-bent construction, and only noteworthy because of their unusual size and capacity. They are 1036 ft. long and 80 ft. wide and at present can accommodate 14,000 spectators. Concrete piers have been built for an ultimate length of 1800 ft., which will accommodate 26,000 persons.

GENERAL FEATURES OF DESIGN

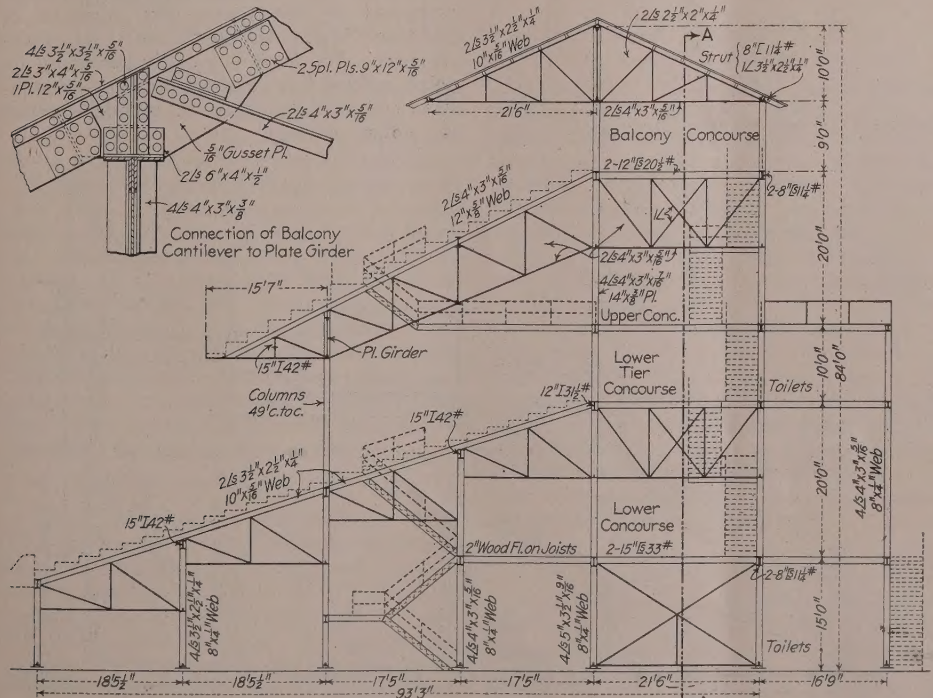
The completed grandstand, shown by the accompanying section and elevation, is 1225 ft. long, but the intention is to extend this to at least 1800 ft. if conditions require it. The total width of about 121 ft. for the typical section consists of 28 ft. for the front boxes, of the wooden construction shown on the detail drawing, and about 93 ft. for the structural steel frame proper. The lower concourse is extended backward 16 ft. 9 in. as shown, and provision is made for upper and lower toilet rooms every eighth bay, where the steel frame is extended upward to support the upper toilet rooms, which have concrete floors between steel beams.

The wide concourse and numerous stairways make the exit and entrance facilities unusually ample. One stair has been provided for each five hundred seats. Steel channel stringers with wooden treads and risers on angle brackets, and two-line gas-pipe handrails are used for the stairs as shown. The flooring throughout is of yellow-pine timber; a detail is shown for the upper tier, and the lower tier consists of a single layer of 2-in. planking. The slopes adopted insure good views of the track from all seats, and the general dimensions and heights provide clear lines of sight from the rear seats.

STRUCTURAL DETAILS

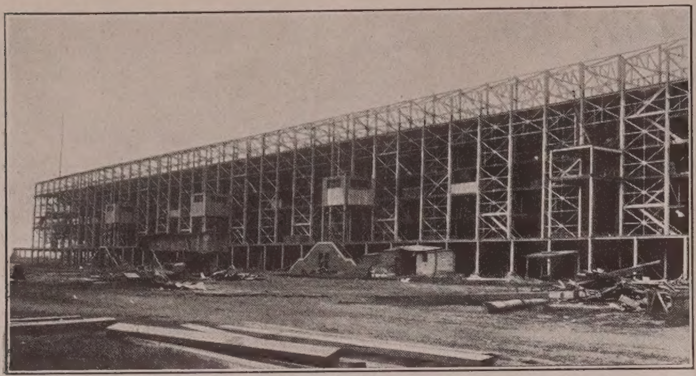
The steel framing is the usual braced column and cantilever truss type of grandstand construction. The columns are spliced at the points of countraflexure under wind stress, and the design is carefully tested for wind bending in the columns. Longitudinal plate girders below the front of the upper tier span three bays and carry the intermediate cantilever trusses at each bay. The detail at the support of this truss on the longitudinal girders is shown in the drawing, and can also be seen in one of the photographs.

The upper roof cantilever is so designed that it can be extended forward in the future to provide greater roof area. The steel sections used are indicated on the cross-section. Rod diagonals are furnished in the plane of the roof and of the upper tier to take erection and wind stresses. I-beam stringers as noted are used to support sloping I-beams spaced 5 ft. 5 1/3 in. apart, on which timber strips are bolted for attaching the timber flooring.



TYPICAL CROSS-SECTION SHOWS STRUCTURAL FRAMEWORK AND DIMENSIONS

Section A-A will be found on the following page.



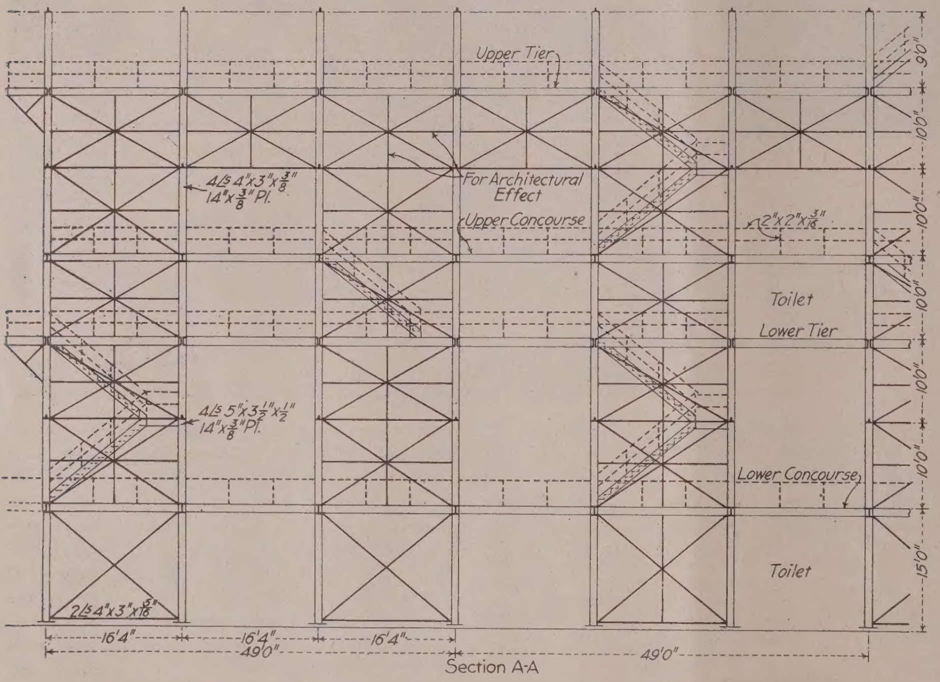
APPEARANCE OF REAR OF GRANDSTAND ON SEPTEMBER 18

VIEW FROM LEVEL OF SEAT ON LAST ROW OF LOWER TIER

Right-hand photograph shows banked track in right distance, end of timber stand for judges in left foreground.

The present capacity of the grandstand is 31,300, consisting of 4500 in the lower tier boxes, 16,000 in the lower tier seats, and 10,800 in the upper tiers. The probable capacity when the length is extended to 1800 ft. will be about 45,000. The ramp shown in the photograph provides entrance to the lower concourse.

A pleasing appearance of the rear of the grandstand will be offered by arched openings in all bays formed by stucco-on-metal walls up to the level of the lower concourse. The bays containing toilets will be inclosed by similar walls, with doors and windows and an arched opening at the level of the lower concourse. The photographs show the general appearance on Sept. 18, when a world's record was made. The longitudinal bracing and some steel details are indicated. The stiff bracing at the hangers for the platforms leading to the upper tiers should be noted.

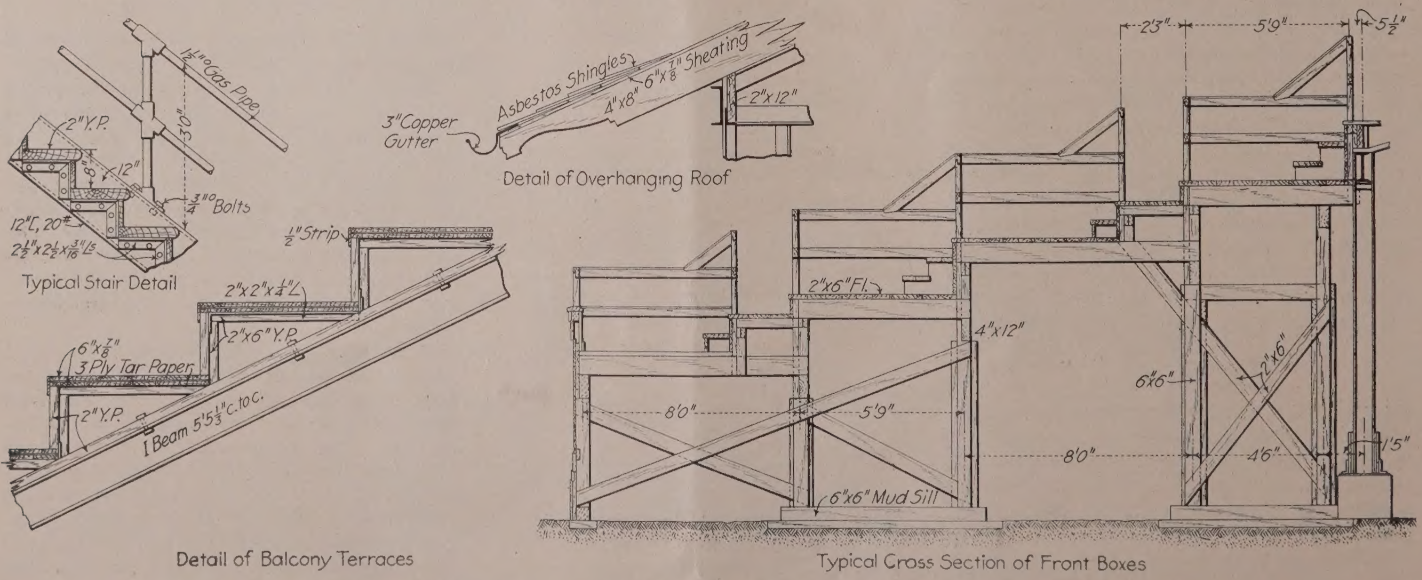


LONGITUDINAL ELEVATION SHOWS TYPICAL BRACING AND COLUMN SECTIONS

The steel frame of the grandstand was erected in thirty working days by the steel contractor, using a stiffleg derrick with a 26-ft. mast and 90-ft. boom, running on rails of 30-ft. gage—considered a good record for the total of 2750 tons of steel. This steel was furnished by the Lackawanna Bridge Company, of Buffalo, and the 3,500,000 ft. of timber in the grandstand and bleachers was furnished by the Florida & Gulf Standard Lumber Company. The chairs were furnished by the American Seating Company.

The design and methods of construction have been worked out by Blaine H. Miller, chief engineer, who designed the Indianapolis speedway, and H. B. Thorn and C. F. Gardiner, assistant engineeers, for the Sheepshead Bay Speedway Corporation, of which Everard P. Thompson is manager and vice-president. The general contractors are the Coast & Lakes Contracting Corporation, of New York, with E. F. Gray as resident superintendent.

ABOUT TWENTY THOUSAND men are now employed by the contractors engaged in building New York City's new rapid-transit lines. The work is rapidly reaching the point where the greatest amount of construction will be going on at one time on the entire project.



DETAILS OF STAIRS, OVERHANGING ROOF, BALCONY TERRACES AND FRONT BOXES, SHOWING MATERIAL USED

Design of Scroll Cases and Intakes for Single-Runner Turbines Analyzed

Part I—Efficiencies of Waterwheels Depend Upon Water Passages as Well as Upon Wheels Themselves—Steady Flow and Absence of Eddies Essential

By A. G. HILLBERG
Hydraulic Engineer, New York City

THE EFFICIENCY of a turbine depends not only upon the design of the runner, but also upon the shapes of the intake, scroll case and draft tube. The high over-all hydraulic efficiency of plant, obtained in tests of single-runner units at the Appalachian plants, at Keokuk and at Holtwood, which are only 2 or 3 per cent less than the efficiency of the turbine itself, could not have been obtained had not the design of the passages of water been studied as carefully as that of the turbine. In the plants referred to above, these passages have been molded in the concrete.

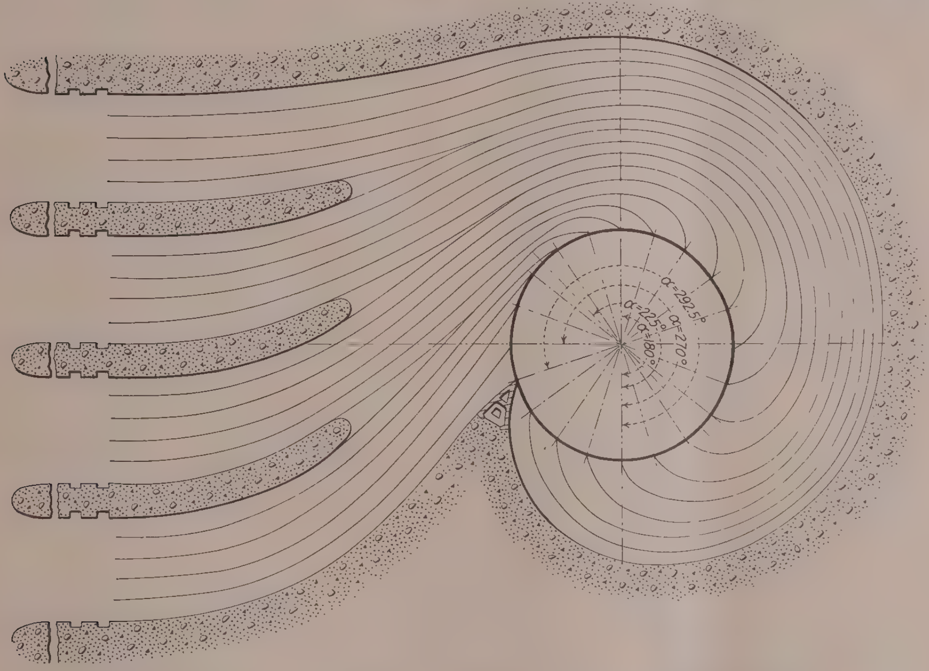


FIG. 1—SCROLL CASE DIVIDED INTO TWENTY IMAGINARY STRIPS OF FLOW

For reaction wheels, operating under medium and high heads, the spiral casing has long been recognized as being the best available type. These casings have generally been made of cast iron and given a tapering shape, as water is diverted into the runner at the same rate throughout the length of the casing. This taper has been so designed as to keep the pressure around the distributor constant. The part between the casing and the runner is designed as a bell mouth for accelerating the flow, so that the water enters the turbine at a higher velocity than that in the casing proper.

Evolution of the Scroll Case

Experience has led designers to establish rules as to the best velocity of flow in these spiral casings or scroll cases. In general the velocity varies from 0.15 to 0.20 of the spouting velocity, $\sqrt{2gh}$, where h is the effective head of the plant. The lower value is used for high heads, and vice versa. In the speed ring this velocity is accelerated to from 0.6 $\sqrt{2gh}$ to 0.8 $\sqrt{2gh}$, at which velocity the water enters the turbine.

Years ago, as turbine units grew larger, the amount of material required in scroll cases of cast iron became unduly high and designers began to use steel plates. As difficulties were met with in making such casings of circular cross-section, they were made square, and channels, Z-bars or angles were used to stiffen the plates. Lately, however, the advances in methods of shop manufacture have permitted the building of circular and tapering scroll casings of steel plates.

When about five years ago the vertical, high-speed single runner was adopted as the standard for low-head plants, the volumes of water to be fed to the turbine became so large that even plate-steel casings were out of the question. Previously smaller single-runner wheels had been placed in open wheel pits, generally square in plan. As in practically all ordinary cases these wheel pits were made too small, and as, furthermore, the flow was uncontrolled, eddies formed, preventing the water from flowing into the runner at the same rate at all points of the periphery. The result was that the rotor of the unit was subjected to unbalanced forces, so that the lower steady bearings wore out at unduly rapid rates. Efforts were made to relieve these bearings by introducing baffle plates in the wheel pits, and gradually the shape of the whole pit became that of a scroll case.

Passages for Water

In a low-head, single-runner installation the passage for the water can be divided into five main parts: Intake, scroll case, speed ring, turbine and draft tube. This article will deal with the intake and scroll case only. The term intake will signify the passage from the front of the head-gate piers up to the point where the scroll case begins.

In designing an intake the designer must avoid abrupt changes in the flow, as eddies formed at these points, will upset the flow throughout the intake and the scroll case. It is, therefore, best to divide the flow into imaginary vertical strips and regulate the velocity of each strip so that no eddies can form.

Suppose that the intake is so large that four gate openings are required, and that the speed ring of the turbine has twenty vanes. The flow, then, may be conveniently divided into either twenty or forty strips. It is, however, usually divided into as many strips as there are vanes. Therefore, assume twenty strips in this case. As there are four gate openings, there will be five of these strips per opening. Fig. 1 shows a scroll case in which the flow has been divided in this manner. Beginning at the scroll case proper and working backward, it will be readily seen that these vertical strips or flow lines are of different lengths. The passages in the concrete, obviously, must be so designed that the water in each flow line moves at the same velocity as that in the adjacent line at points where such lines meet or run alongside each other. Otherwise eddies will form.

As the lengths of these flow lines vary it is necessary to separate the groups belonging to each headgate opening. This is readily done by the introduction of piers, which also serve to break up the span of the roof of the intake. Theoretically such piers should be carried out to a knife edge on their downstream side, but it is impossible to do this in concrete, and as, if it were done, the flowing water would soon eat away the edge, it is necessary either to provide a knife edge of steel plate or cast iron, or to end the pier with a suitably rounded edge. Examples of such designs are shown in Fig. 2.

Velocities

The velocity of the water through the racks and the headgate openings should be kept as low as possible so as to make the loss in head due to the entry small. Under no circumstances should this velocity exceed 5 ft. per second, in which case the loss in head due to entry would be less than 0.2 ft. For wheels operating under heads lower than 30 ft. this loss due to entry would be excessive, and a lower velocity should be used. The losses due to entry should never exceed 0.5 per cent of the total head.

Assuming that this loss is permitted to be 0.5 per cent we have that, as

$$v = \sqrt{2gh_v} \text{ and } h_v = v^2/2g = 0.01h$$
$$h_e = 0.5(v^2/2g) = 0.005h$$

or

$$v = 0.8\sqrt{h}$$

A plant operating under a head of 25 ft., therefore, should have a velocity of 4 ft. through the headgate openings, and the loss due to entry would be 0.125 ft.

In many instances, however, the roof of the intake opening lies so high that when the water level in the forebay is low a velocity of $0.8\sqrt{h}$ per second, with the corresponding depression of the water level in front of the gate opening, might draw air into the turbine. In such cases the velocity must be kept below the critical velocity.

Velocity Acceleration Saves Space

The velocity through the headgate openings can be maintained throughout the intake and the scroll case, but as a sufficient amount of concrete must be provided between the different units in the plant to

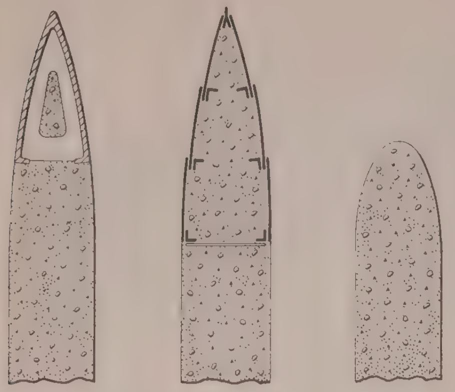


FIG. 2—THREE EXAMPLES OF GOOD PIER ENDS

carry the weight of the substructure, the horizontal unbalanced part of the hydrostatic pressure and the water pressure on the partition walls when adjacent units are shut down, it is often necessary to accelerate the velocity of the flow in order to economize on space. When the flow is accelerated the passage is made smaller and more space is available for concrete. As the velocity through the headgate openings is known, it is necessary to determine the velocity in the scroll case and the distance between the headgates and the scroll case proper in order to determine the rate of acceleration. This increase in velocity should be a constant amount per linear foot.

The rate of acceleration should also be maintained in the scroll case. When points of equal velocity have been determined on the flow lines, these points should be combined by curves, and if any irregularities are discovered they should be adjusted. The boundary lines of the two extreme flow lines will determine the limits of the concrete.

SCROLL CASE

When the flow lines are carried around the scroll case they naturally decrease in number each time a speed-ring vane is passed, as shown in Fig. 1. The maximum velocity in this part must be kept low enough so as not to cause erosion of the concrete. Either this maximum permissible velocity can be assumed at the end of the scroll case, and the velocity accelerated at a uniform rate from the headgate opening to the end of the scroll, or the velocity at the beginning of the scroll can be determined by the formula

$$v = c\sqrt{2gh_o}$$

where $c = 0.15$ to 0.18; g, 32.16, and h_o, the net operating head. As only the maximum, minimum and average heads on the plant are known, the net operating head must be guessed at. For this purpose the writer has derived the following empirical formula, which for average heads between 7 and 65 ft. gives very close results:

$$h_e = h_a - (\sqrt{h_a})/3$$

where h_o is the net operating head and h_a the average head.

As soon as the operating head is known, the most suitable velocity of flow at the beginning of the scroll can be calculated. Many engineers prefer to keep this velocity constant throughout the scroll, but, if the water be accelerated at a uniform rate in the intake, it is better to keep this rate of acceleration in the scroll also.

The next step in the calculation is to determine where the scroll case actually begins. Theoretically the best place is on the transverse axis of the unit, in which case the angle α in Fig. 1 is 180 deg. The whole discharge Q then passes through the vertical plane through this line, and, at the opposite side, where $\alpha = 0$, an area sufficient to pass $Q/2$ must be provided. This, however, sometimes makes the breadth required by the unit unduly large. To economize on space, and, consequently, concrete as well, it is advisable to place the end of the scroll at another point. Calling the discharge in the scroll case to the left of the unit D_1, and that to the right D_2, Table 1 shows the discharges to be provided for.

TABLE 1—DISCHARGES TO BE PROVIDED FOR AT DIFFERENT POINTS IN THE SCROLL CASE

α	180°	225°	270°	315°	360°
D_1	Q	$7Q/8$	$3Q/4$	$5Q/8$	$Q/2$
D_2	$Q/2$	$3Q/8$	$Q/4$	$Q/8$	0
Total	$3Q/2$	$5Q/4$	Q	$3Q/4$	$Q/2$

Not much difference in efficiency exists between the cases where $\alpha = 180$, 225 and 270 deg. Where α is larger than 292.5 deg. the curvature of the side of the intake will be so sharp that it is almost impossible to prevent the formation of an eddy. The effect is that less water will enter the runner at that point, thus subjecting the runner to an unbalanced thrust.

The general rule applies to all cases that the intake masonry should be an easy curve and as nearly as possible a smooth continuation of the speed-ring vane.

In cases where the available space necessitates making α larger than 292.5 deg. it is sometimes advisable to shape the concrete so as to feed the water in a radial direction against the speed ring for a certain distance. In doing this the forming of an eddy at the corner will be prevented, but the runner will, nevertheless, be subjected to an unbalanced thrust. The thrust in this case would be opposite in direction to that had an eddy been permitted to form. In feeding the water directly against the turbine for a small part of the circumference of the speed ring one advantage will be gained in that no decrease in the efficiency of the turbine will take place, which is the case if eddies are formed.

The speed-ring vane at the end of the scroll case must be specially designed so that the concrete can be anchored to it. It should also be carried out far enough to protect the tapering end of the concrete and prevent the excess pressure at the end (due to the higher velocity) from breaking through the concrete. In most cases a thickness of from 18 to 24 in. will suffice. Fig. 3 shows two scroll noses of good design.

To save metal only one side of the concrete needs to be protected, but in that case care must be taken to make the joint as long as possible to prevent seepage.

As the reduction in area of the scroll will decrease the hydraulic radius of the stream, that is, make $R = a/p$ smaller, it is obvious that some adjustment must be made in the sizes of these areas. As the influence of the skin friction on the stream is in direct proportion to the square of the velocity, which in turn is in direct proportion to the square root of R, this correction in area must be in direct proportion to R. But R is in direct proportion to a, which indicates that by making a larger, the influence of the skin friction can be kept constant.

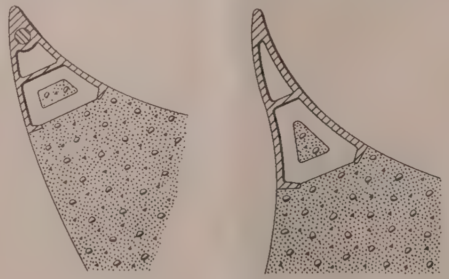


FIG. 3—TWO SCROLL NOSES OF GOOD DESIGN

CURVATURE OF SCROLL

There is, however, another factor to be taken care of. The path of the stream is not linear, but spiral. The radius of the curvature at any point can be determined by the formula

$$R = \frac{\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{3/2}}{\frac{d^2y}{dx^2}}$$

where R is the radius. Introducing x_1 and y_1, the co-ordinates of the point on the curvature, the value of R for the point in question is obtained.

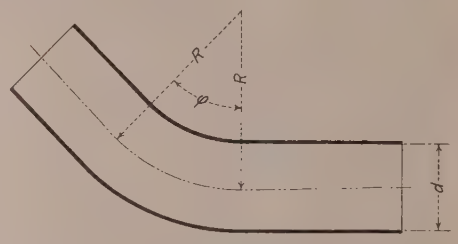


FIG. 4—DIAGRAM FOR DETERMINING n

The co-ordinates α and β of the center of curvature are

$$\alpha = x_1 - \frac{\frac{dy}{dx}\left[1 - \left(\frac{dy}{dx}\right)^2\right]}{\frac{d^2y}{dx^2}}$$

and

$$\beta = y_1 + \frac{1 + \left(\frac{dy}{dx}\right)^2}{\frac{d^2y}{dx^2}}$$

These formulas apply in cases where the equation of the shape in plan of the scroll has the form

$$y = f(x)$$

If this is not the case, that is, if the equation is expressed in polar co-ordinates, or

$$\rho = f(\theta)$$

this radius and the corresponding co-ordinates of the center of curvature must also be expressed in polar co-ordinates, or

$$R = \frac{\left[\rho^2 + \left(\frac{d\rho}{d\theta}\right)^2\right]^{3/2}}{\rho^2 + 2\left(\frac{d\rho}{d\theta}\right)^2 - \rho\frac{d^2\rho}{d\theta^2}}$$

For applying these formulas the shape in plan of the scroll must be known. The various areas are located in radial directions and, consequently, the equation of the shape can sometimes be more conveniently expressed in polar than in orthogonal co-ordinates. It is not necessary, however, that the shape of the curve be a true spiral, and it seldom is. Several of the higher-plane curves lend themselves well for this purpose, and as, later on, when the different areas are known, the shape of the scroll in plan might have to be modified, it does not matter much what curve is used in the original calculations. Curves that can be used for the first calculation are the involute of a circle, the spiral of Archimedes and the logarithmic spiral.

RADIUS R

Theoretically the radius R decreases throughout the curvature and is not equal for two succeeding points. Considering, however, that the circle of curvature at any point has three points in common with the curve, that it would be well-nigh impossible to build forms for the concrete as accurately as the curvature could be calculated, and that, furthermore, the change in radius per linear foot of curvature is small, it is customary to use the same radius for several sections. Assuming that the subtended angle for a certain part of the curvature having the radius R is φ (see Fig. 4), the head lost due to the curvature in this part would be

$$h_f = n(\varphi/90)\ (v^2/2g)$$

where

$$n = 0.131 + 0.163(d/R)^{7/2}$$

In this formula d is the width of the scroll case outside the vanes of the speed ring. Values of n calculated from this formula for various values of the ratio (d/R) are given in Table 2:

TABLE 2—VALUES OF n CORRESPONDING TO VALUES OF d/R

d/R	n	d/R	n
0.2	0.131	1.2	0.440
0.3	0.133	1.25	0.487
0.4	0.138	1.3	0.539
0.5	0.145	1.4	0.661
0.6	0.158	1.6	0.977
0.8	0.206	2.0	1.98
1.0	0.294		

As a certain amount of water is diverted into the turbine throughout the length of the scroll and the velocity of flow is kept constant, except for the slight increase due to acceleration, no friction losses take place, because of the contraction of the section, other than those due to the decrease in R.

PRACTICAL METHOD

As seen above the friction losses in a scroll case can be determined with accuracy. The method outlined, however, involves lengthy computations, and as all losses are in proportion to certain areas, turbine designers generally use empirical rules whereby the influence of the friction can be allowed for. The method consists simply of enlarging the sections a certain predetermined amount. As the influence of the friction grows larger in proportion as the areas get smaller, the areas must be increased in accordance with a sliding scale. If the succeeding sections to be calculated of a scroll case are numbered 1, 2, 3, 4 . . . n it is customary to enlarge them 0, 1, 2, 3 . . . $n-1$ per cent. Experience has shown that smaller scroll cases designed in this manner have a high hydraulic efficiency.

Good judgment, however, should be exercised in selecting a suitable sliding scale, as large sizes of the casing and low velocities of flow may in certain cases require the adoption of a smaller scale than that given. When the shape of the scroll and the velocity are known approximately, the formulas given above can be used in a rough sort of way to give the designer an idea of what the proper scale to use would be. As the designer cannot predict the quality of workmanship of the concrete in the finished scroll case, it is always advisable to use a slightly larger increase in the scale than the theoretical computation indicates.

(To be concluded)

City Planning—How It Should Be Prosecuted—Why It Is the Engineer's Work

Nelson P. Lewis Discusses Further Details of This Work and Urges Engineers to Take a Broader Part than Executing the Ideas of Others

PART of the paper on city planning presented by Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment, New York City, at the recent International Engineering Congress was presented in the Engineering Record of last week, page 382. In that part Mr. Lewis defined and discussed four main elements of the city plan—the transportation system, the street system, the parks and recreation facilities, and the public buildings. The remainder of his paper goes further into the means of preparing the city plan, treats of its financing, and ends with an appeal to the engineer to take a broader part in the development of the city than merely making the surveys and carrying out the ideas of others. These additional notes are taken from the paper.

ADAPTATION TO TOPOGRAPHY

That the various elements of a city plan should be adapted to the topography of the site seems so obvious as to need no special emphasis, yet there are numerous instances where this has been done only to a limited extent. The topography should, in fact, be the first thing to be considered in determining general features of the comprehensive plan. Upon it will especially depend the system of main drainage, provision for which must be kept in mind from the beginning, and the transportation system which, while it will naturally be designed to carry people where they want to go, should be able to follow the lines of least resistance, excessive grades and sharp curves involving not only heavy operating expenses but a certain amount of danger.

The first step is to secure a good topographic survey of the territory to be platted. Sometimes this initial survey is made in far more detail than is necessary, the idea being that a complete street plan is to be made at once. The time and expense of doing this could be used to better advantage in a study of the larger aspects of the problem or in working out only the skeleton plan. The survey required for the first study should show existing roads with the location of buildings fronting on them, the actual drainage, including both the valleys and the ridges dividing the drainage areas, the existing railroads and routes suitable for additional lines, the waterfront, if there be one, and the localities best adapted to the accommodation of water-borne commerce and the places which, from their picturesque features, are most suitable for park reservations. Further details are not required for the first study of the plan; they will come later.

A contour map or a model will be of great help in laying out the first skeleton plan. When this has been determined and the time comes to fill in the details, further surveys will be necessary, but they can be taken up one section at a time as each of the areas lying between the arterial streets can and should be studied separately. In this connection, proper drainage should be the first consideration, while the location of property lines will be of great assistance in so planning the minor streets as to avoid damages, caused by leaving unusable remnants, wherever it is possible to do so, and still secure a rational and convenient plan.

EXCESSIVE GRADING TO BE AVOIDED

The first step in the physical creation of a street system is the grading, and as this comes at a time when the value of the abutting property is small, the cost should be kept down to the lowest figure consistent with a reasonable plan. The preference for rectangular blocks which will produce the greatest possible number of right-angled lots is so general that excessive grading and needlessly steep grades are frequently the price paid to secure them. This policy often defeats its own purpose, as the grading up or down of the abutting lots is likely to involve a cost greater than the value of the few lots gained by a rectangular system over those which would result from one conforming more closely with the natural surface, while the latter would be far more attractive. A long sweeping curve may be a pleasing feature of a street plan on level ground; diagonal streets to afford direct access from one part of the tract to another are always desirable; but a series of sharp curves and frequent abrupt changes of direction are as inappropriate for a level site as are straight lines regardless of natural contours for a rugged site.

The sites for public and semi-public buildings should receive consideration in the first topographic survey. Such buildings should not only be placed where they can be seen from the streets approaching them, but wherever possible, they should be placed at grade summits.

There may be some precipitous hillsides or deep ravines in the area to be platted and, while these are of little value for other purposes, they will make admirable parks. They should be located in the topographic survey and the main roads should be so fixed as to afford easy access to them when they become public pleasure grounds.

The general plan should be adapted to the topography. Attempts to create on a level plain a city having the picturesque features of a hillside town will result in failure, while to lay out on a rugged site a plan suited to a level or gently sloping tract will not only involve needless expense, but will sacrifice opportunities for charming effects and produce a result which is palpably commonplace.

STREET DETAILS

While the general plan for the streets and roads of a city and its environs may have been well thought out, and while the streets may be of generous width and of good alignment and may have been skillfully located with respect to the topography, their traffic capacity may be less than it might be, owing to improper proportions of roadways and sidewalks. The roadway pavements may be unsuited to the character of the traffic or to the grades. Injudicious tree planting or the entire absence of planting may make them bare and unattractive. There are many details of street arrangement and design worthy of the most careful study, and even when these details have been carefully worked out for one street, or for streets of different classes and widths, a standard cannot safely be adopted for every street of the same class and width. The undesirability of long straight streets at fixed intervals, each of the same width, has already been pointed out. Equally objectionable is the identical arrangement of the minor details on each of these streets.

Trees

The importance of trees in a city street cannot be over-estimated. Their position should therefore be one of the street details to receive careful study. The practice of placing them immediately back of the curb is quite general, and where buildings are placed on the street line it may be necessary to do so in order to give them space for growth. If they are placed between the sidewalk and the building line, however, the street acquires an added dignity and appears to be wider than where the trees are placed along the curb.

The orderly arrangement of the great variety of structures beneath the surface of city streets should receive careful consideration in city planning, but the lack of attention to this detail has been conspicuous. The provision of subways or galleries for the accommodation of all underground structures has frequently been urged as the only effective remedy for the conditions which so commonly exist and which involve the continual mutilation of the street surface in order to reach the various pipes, mains and conduits. Yet it will be difficult to find two cities where the street pavements are in better general condition than in Liverpool or Berlin, the former conspicuous for its excellent stone-block, and the latter for its good asphalt pavements; yet neither of these cities has built pipe subways. The reason for the admirable condition of their streets is probably due to efficient administration and also to definite regulations covering the precise location of pipes and other structures of different classes beneath the roadways and sidewalks, avoiding thereby the exploration beneath the surface for the purpose of finding what is wanted when repairs are necessary.

Height and Other Limitations

Limitations as to the height of buildings, the proportion of the lot which may be built upon, and the general arrangement of buildings, are commonly referred to in the United States as restrictions. In European countries it is quite generally taken for granted that the city will make such regulations as are calculated to insure to the citizens at large the full enjoyment of all the advantages which a well-organized city should supply, and prevent such acts of the individual or such use of private property as will in any way militate against such enjoyment. Among these advantages, besides the free and safe use of the public streets, may be included freedom of obstruction of light and air by a neighboring owner; prohibition of the appropriation of public property to private use; guarantee of the preservation of the character of a district when once established by protecting it against invasion by industries, uses and occupations inconsistent with that character; conservation of the value of private property by a consistent scheme of development and improvement; prohibition of the erection of structures, either permanent or temporary, which will offend the eye, or of anything destructive of amenity.

The right of the city to control and prevent the private occupation of its public streets is so obvious that it can scarcely be questioned, but the modern idea that the obligation of the city to its citizens is much more comprehensive and extends to the use which may be made of the property outside the street lines and which is actually owned by individuals, is not so generally accepted on the part of the owners of real estate, although regulations affecting the use of private property are now becoming quite general. The most common regulations of this kind are those affecting the arrangement and height of buildings. The most obviously necessary are those governing the proportion of lots which may be built upon and the arrangement of the buildings and open spaces, as these are essential to good sanitation and decent living. Those designed to limit the height of buildings are not always accepted as reasonable.

Sizes of Blocks

The sizes of blocks and lots have become so standardized, especially in the United States, that they are likely to control the street layout. This has tended to prevent the most successful treatment of the smaller subdivisions which go to make up a great city. The building plot of 100 ft. in depth has become a habit and seems to persist without regard to its adaptability to either general or special conditions. But the poor man should have the opportunity to pay for as little land as will provide the home he wishes with an insurance of sufficient light and air about it to make that home decent and healthful. A cottage 25 or 30 ft. in depth does not need a lot 100 ft. deep to accommodate it. Why, then, should not the builder of such a cottage be able to secure a lot of suitable size on which to place it?

Financing a City Plan

The development of a proper city plan is a slow process requiring years of painstaking work, but to carry it out physically will require much more time. The work must be done progressively as needed and it is of the utmost importance that such work should be sanely financed. There are several ways in which the cost of improvements included in the plan can be met; by direct assessment upon the property which will be benefited by each particular improvement, by making the expense a general city charge or by a combination of the two methods.

Conditions in different cities, in the several parts of the same city, and at different stages of its growth and development, vary so greatly that the same methods of financing will not be applicable to all cases. In the small town—and no town is so small that it does not need a plan—the creation of a public square about which or in which the chief buildings including, perhaps, the churches are to be grouped is of general interest and benefit to the entire community. All public activities and even recreation and amusement will center there, and it will be conceded that the town itself should properly pay the expense. If the main street of the town needs widening, straightening or extending, the benefit will again apply to the entire community. But the town grows and becomes a city; other main streets must be provided; other centers of activity or recreation are needed. These new projects will still result in some general benefit but in a large measure of special benefit. Hence the fair share to be assumed by the town will be less in proportion to the amount of special benefit resulting to the particular locality.

It remains for the town to determine whether it is to pay all or part of the cost of any improvement, and, if its credit is such that it can borrow the necessary funds, whether it will issue its bonds for a long term of years or whether it will carry out the improvement on a cash basis by tax levies or short-term bonds.

A large city is really a group of small towns grown together. While there are certain great projects commonly deemed of general interest, there are few which do not involve some special benefit to a particular locality.

The Neglected Responsibility of the Municipal Engineer

The keenest interest in city planning has heretofore been shown by architects, landscape architects, artists, students of civic affairs, social workers, etc., while engineers appear to have been content to carry out the physical work along lines already laid down or, when called upon to make plans for future development, to adopt the conventional features followed by their predecessors. Engineers engaged in this particular class of municipal work have so long been accustomed to doing things when they are told, as they are told and because they are told by those whose function they have thought it to be to determine general plans and policies, that they are to a large degree responsible for the idea so generally prevalent that the chief work of the engineer is to carry out the ideas and policies of others. The exercise of vision and imagination on their part has too often been deemed a dangerous incursion into a field foreign to their proper activities; and yet the engineer is the first man on the ground in laying the foundations upon which our cities are to be built. He has been too prone to regard this preliminary work as a mere matter of surveying, and he has been more intent upon the accuracy of his measurement of lines and angles and of his computation of areas than upon the larger problem of providing for the orderly and sightly development of the city.

The City Plan Is Never Finished

The making of a comprehensive plan for the future development of a city or for correcting the obvious defects of an existing plan is no work for an expert who may be called in for a few weeks or months and who, it is fancied, may have an inspiration which will solve all the difficulties which are apparent. Acres of plans have been made in this way; they have been exhibited, admired, filed away and forgotten. The creation of a proper plan is more likely to be the result of years of patient work, and the men who did it will be forgotten before it is finally carried out. It is no one-man job and it is never actually finished. However carefully and skillfully the first plan may have been made, unforeseen changes will take place, new methods of transportation will be developed, new inventions will powerfully affect the social life of the community, and the plan, where still susceptible of change must be modified to meet the changed conditions.

Comprehensive city planning can best be done by the regularly employed technical staff of the city, but the organization created for this purpose should be carefully selected. It should contain men who are familiar with the past history and traditions of the community and are in sympathy with them, but who can appreciate changing conditions and adapt the old to the new without destroying it. The work should be directed by men who do not think the exercise of imagination an engineering crime; men who are enthusiasts without being doctrinaires; men who are content to do their work well without hope of popular applause and who are willing to await the verdict as to their work which will be rendered by coming generations. They will not, however, be obliged to wait indefinitely for recognition if they manifest an intelligent interest in this subject and an appreciation of its importance. The work of planning as well as that of building a city is so obviously that of the engineer that he has but to reach out and take it. Other expert advice will be needed, that of the architect and the landscape architect; such advice should always be welcome and in some respects their judgment should be controlling. If the engineer does not assume this task and show his capacity for it, he will have no one but himself to blame if others take it away from him.

Railroad Net Revenues Gained Slightly in Last Fiscal Year

NET OPERATING revenue and income on the railroads of the United States showed a slight gain for the fiscal year ended June 30, 1915, as compared with the previous year, according to a bulletin issued by the Bureau of Railway Economics. This was despite a decrease in gross operating revenues. The figures given in the accompanying table show that the improvement was all in the Eastern district, where an abnormally high operating ratio had prevailed in 1914, and where in 1915, in consequence, it was possible to effect a reduction in operating expenses of 10.0 per cent with a decrease in gross revenues of only 4.9 per cent.

REVENUES AND EXPENSES PER MILE OF LINE OF STEAM RAILROADS OF UNITED STATES FOR FISCAL YEARS ENDED JUNE 30, 1915, AND JUNE 30, 1914

	United States			Eastern District			Southern District			Western District		
	1915	1914	Inc., Per Cent	1915	1914	Inc., Per Cent	1915	1914	Inc., Per Cent	1915	1914	Inc., Per Cent
Total operating revenues.	$12,641	$13,483	d6.3	$21,790	$22,916	d4.9	$10,019	$11,181	d10.4	$9,282	$9,836	d5.6
Total operating expenses	8,894	9,801	d9.3	15,767	17,516	d10.0	7,323	8,141	d10.0	6,239	6,744	d7.5
Net operating revenue..	3,747	3,682	1.8	6,023	5,400	11.5	2,696	3,040	d11.3	3,043	3,092	d1.6
Operating income	3,158	3,078	2.6	5,079	4,441	14.4	2,253	2,588	d12.9	2,570	2,603	d1.3
Operating ratio, per cent	70.4	72.7		72.4	76.4		73.1	72.8		67.2	68.6	

d Decrease.

For the month of June, 1915, comparing with June, 1914, gross operating revenues in the whole country fell only from $1,097 to $1,090, while operating expenses were reduced from $789 to $730. This effected a gain in net operating revenue of 16.9 per cent and a gain in operating income of 21.2 per cent. The operating ratio was reduced from 71.9 to 67.0.

The improvement in the Eastern district was even more striking, where an increase of 3.3 per cent in gross operating revenue was met with a reduction of expenses of 7.4 per cent, resulting in a reduction of the operating ratio from 73.7 to 66.0, and an increase of operating income of 39.2 per cent. In the other districts small losses in gross revenues were met with larger reductions in expenses, resulting in material increases in net income.

Deep Tunnel Completed in Unsound Rock Solidified by Extraordinary Grouting

After Rush of Water and Débris Flooded One End of Astoria Tunnel, New York City, Fissures Were Plugged from Behind Bulkhead in Other End

THE MOST SERIOUS trouble experienced in the construction of the Astoria gas tunnel under the East River in New York City was caused by a flow of 10,000 gal. per minute breaking through the Astoria end of the last 122 ft. of bench remaining to be excavated after the top heading had been holed through. This break flooded the Astoria end of the tunnel on Oct. 5, 1913, and the work of removing the bench was not resumed until Feb. 5, 1914. In the meantime high-pressure grouting from behind a bulkhead at the Bronx end of this stretch of bench, both into the fissure below the tunnel from which the flow came, and into the heading above the bench, as far as the bulkhead on the Astoria side of the break, was resorted to. The entire work of constructing the tunnel is described by J. Vipond Davies, of Jacobs & Davies, New York City, who supervised it, in a paper published on page 1405 of the August *Proceedings* of the American Society of Civil Engineers. The paper will be presented before the society Oct. 6. These notes describing the overcoming of the trouble above mentioned are taken from the paper.

This tunnel, 4262 ft. long, was driven, between stations 35 and 39, station 0 being at the Astoria shaft, through a decomposed dolomite, which formed a disturbed contact zone between Fordham gneiss on the north and Inwood limestone on the south. The tunnel extends at a depth of more than 225 ft. from the Astoria plant of the Astoria Heat, Light & Power Company, opposite Little Hell Gate, to the 132nd Street distributing station of the company in the Bronx. It carries two 72-in. gas mains with provision for two more to be added at a later date. At the point referred to a channel more than 80 ft. deep exists, and a water pressure of 95 lb. per square inch was found.

The tunnel crosses the contact line at an acute angle. By driving headings outside the tunnel lines and more nearly parallel to the contact, thus keeping in relatively sound rock, it was possible to drill cross holes into and above the strata to be pierced by the tunnel itself, and to consolidate these strata by grouting at high pressure. In this way the headings were holed through.

LARGE FLOW ENCOUNTERED

After the meeting of the headings on July 17, 1913, efforts were concentrated on the removal of the remaining bench, which at that time amounted to 474 ft. This length of excavation was attacked from both ends. For the first 237 ft. on the Astoria side and for a considerable distance on the Bronx side no serious difficulty was encountered, the rock on the Astoria side being good, sound dolomite and that on the Bronx side partly but not badly disintegrated. Work proceeded until test holes disclosed the presence of excessive water at the Astoria end. The total flow from these holes at high pressure was about 1500 gal. per minute. The holes were piped for grouting, and incased in an inclined concrete buttress, 20 ft. long and extending from the haunch of the arch to the rock bench. After this buttress had set for one week, the valves of the drains were closed preparatory to grouting, when the water broke through the top of the bench at the toe of the buttress. It was then decided to place a full-section emergency bulkhead at each end of this remaining 122-ft. section of bench. On the completion of these bulkheads the inclined buttress was removed and a much heavier one, 34 ft. long, was constructed. At the same time the western side of the bench top, at the Bronx end, was covered with a 23-ft. inclined buttress extending from the recently constructed Bronx emergency bulkhead to a heading emergency bulkhead on top of the bench which had been placed during the driving of the Astoria heading. A similar inclined buttress was placed against the west side of the arch, thus covering the entire 122 ft. of exposed bench on the west side by a series of concrete bulkheads and buttresses.

After allowing these structures to set, grouting through them began, 139 bags of cement being injected successfully into the two shorter buttresses. The grouting of the heavy 34-ft. buttress was not successful, as the structure cracked badly from the pressure developed by closing the drain valves. It was then decided to remove this buttress entirely and replace it with one in the form of an inverted arch to react against the permanent roof arch already in place. Removal of this buttress was done by blasting with extremely light charges, and was completed about 8 a. m. Sunday, Oct. 5, 1913.

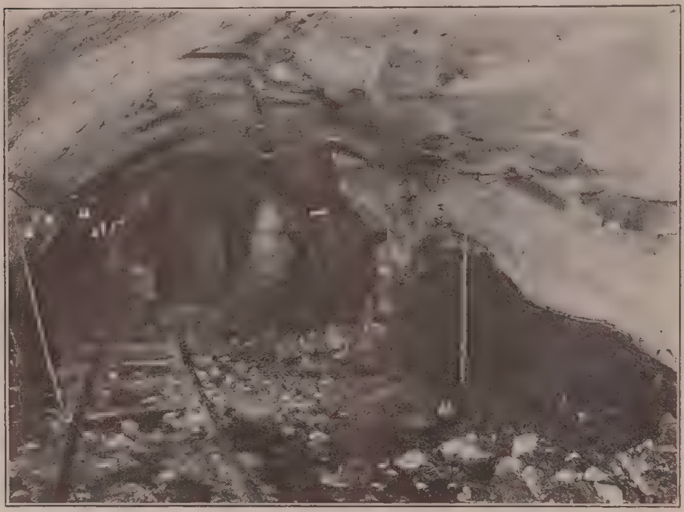
TUNNEL FLOODED

Shortly after 8 a. m. a large flow of water, carrying greensand, burst forth under high pressure from the top of the rock bench about 15 ft. from the Astoria emergency bulkhead. After flowing 30 min. the flow abruptly ceased, only to burst forth again a few minutes later with a volume of approximately 10,000 gal. per minute, which eventually overcame the capacity of the pump at the Astoria end. The bulkhead doors were promptly closed. On the Bronx side the force of the water was broken by the intervening heading bulkhead, and the workmen were able to close the drains. On the Astoria side, owing to the rush of water and sand, they were able to close only two of the three drains in the bulkhead. It was found later that a small piece of 1-in. board, floating in the water, had become wedged between the door and the door frame of the bulkhead on the Astoria side. Through the small opening thus caused and through the drain pipe which the men had not been able to close, the water poured into the tunnel, carrying with it a large volume of dolomitic sand and débris. The water in the Astoria shaft rose steadily until, at 3.15 p. m., it had completely submerged the pumps. At this time the pumping plant in the Astoria shaft consisted of twelve pumps with an actual discharge of probably 5500 gal. per minute.

Immediately following the flooding of the Astoria end, the Bronx emergency bulkhead was strengthened by a reinforced central buttress. On the completion of this buttress an additional emergency bulkhead was built 105 ft. nearer the Bronx shaft. The actual need of this bulkhead never arose, as the first one withstood the full hydrostatic pressure.

Grouting from Bronx End

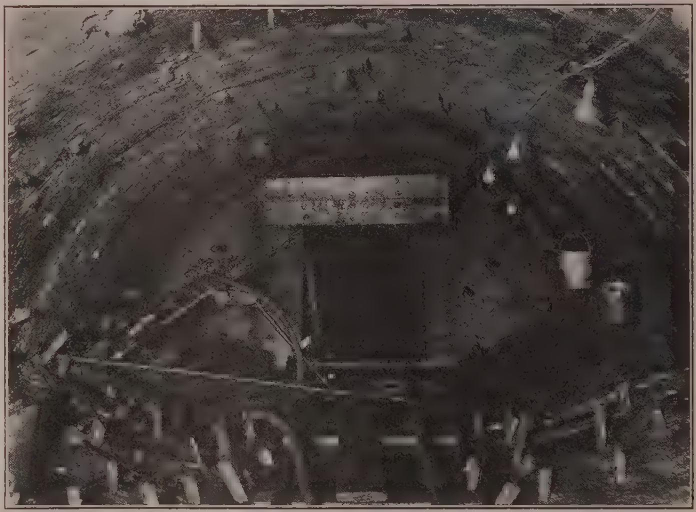
Observations of the rise of water in the Astoria shaft were carefully made, and also the tidal readings during the continuance of the shaft inundation. The water rose and fell with the tide, but the entire tidal rise was not obtained, the rise in the shaft being only about one-half that in the river. From the continuance of these conditions and also from the flow obtained through small pipes in the Bronx bulkhead, it was apparent that the flow had not choked itself as had been hoped. It was decided to grout from the Bronx end into the water-filled chamber between the Astoria and Bronx bulkheads, with the object of filling this with cement to permit the unwatering of the tunnel from the Astoria end. At the same time diamond-drill borings were driven from the Bronx bulkhead, the purpose of which was to intercept the fissure at a point beyond its opening into the tunnel, and through this to inject cement, in an effort to seal the source of flow beyond the tunnel. The first drill hole was intended to tap the fissure at a point 5 ft. below and 5 ft. beyond the point of flow into the tunnel. This hole measured 120 ft. from the bulkhead face to the point. The accuracy of both the location and pointing of this hole was conclusively proved by the injection of 870 bags of cement and by the conditions disclosed when driving through this section in February, 1914. The grout in this instance was evidently well directed into the fissure, but naturally could go no further than the débris in the fissure would permit.



LEFT—HIGHLY STRATIFIED GROUT BEING REMOVED FROM HEADING SPACE BETWEEN BULKHEADS

Grouting through a diamond-drill tube into the heading space began at 3 p. m. Nov. 10, and continued without interruption until 4 p. m. Nov. 12, during which time 8850 bags of cement were injected at a pressure of 400 lb. per square inch. The grouting was discontinued on the appearance of cement in the seepage around the Bronx bulkhead door.

From the action of the water in the Astoria shaft, it was quite evident that this grouting had been effective in sealing to a large degree the direct passage between the tunnel and the river, but had not entirely sealed the leak through the Astoria bulkhead, as the draining of water through numerous small pipes in the Bronx bulkhead lowered the water in the Astoria shaft 17 ft. The reduction of head thus caused on the water in the tunnel resulted in an unbalanced pressure on the freshly injected grout in the fissure, so that when an absolute pressure of the 11 lb. existed on the fresh grout, the grout gave way, causing water from the fissures to flow into the tunnel again and the water in the shaft to rise. Consequently on Nov. 14 and 15 2699 additional bags of cement were injected into the heading space, when the pressure gage on a pipe extending through the bulkhead began to jump in excess of the hydrostatic pressure and grout began to appear through the bulkhead pipes. Again on Nov. 17 an additional 164 bags were injected through this tube, making a total of 11,342 bags of cement.



RIGHT—INVERTED ARCH BUTTRESS—NOTE LARGE NUMBER OF HOLES FOR GROUTING BENCH

Meanwhile the diamond-drill borings had been continued, and although water and greensand were encountered, only a small quantity of cement could be injected. It was evident on removing this piece of bench that the fissure in question was pierced only by the first drill hole. On opening various pipes in the Bronx bulkhead it was found that they gave water without pressure, and therefore it was considered safe to begin the unwatering of the tunnel from the Astoria end.

Unwatering with Air Lift

Existing in the Astoria shaft prior to the flooding were an 18-in. ventilator pipe and three 8-in. discharge lines. These four pipes were converted into a pneumatic water-lift system by placing a 3-in. air pipe inside the 18-in. ventilating pipe, extending to a depth of 240 ft. below mean sea level, and by placing a 2-in. air pipe inside each of the 8-in. lines to the same depth. The discharge ends of these air lines, for some 24 in. in length, were perforated with small holes drilled at an angle of 45 deg., so that the air discharge would point upward. These air lifts all discharged at the shaft surface. This emergency equipment was the only means used to lower the water 176 ft. from the top of the shaft, and proved both rapid and effective. The 18-in. and two of the 8-in. air lifts, which were operated continuously from 8 a. m. to 9 p. m. Nov. 24, discharged an average of 1349 gal. per minute.

An emergency pumping plant had been secured and prepared for operation, consisting of two pumps with a combined capacity of 1800 gal. per minute on a steel pontoon floating in the shaft, and three 600-gal. pumps placed in the elevator wells after the water had been lowered by the air lift. These pumps were lowered from time to time as the water dropped until, at 10.40 a. m. Nov. 30, the original shaft pumps were started and the water quickly drained from the tunnel.

Condition of Unwatered Tunnel

On the evening of Nov. 30, with the water 4½ ft. below the crown of the arch at the portal, two boats containing the tunnel engineers entered the tunnel and made a tour of inspection to the Astoria bulkhead. Comparatively little damage had been done by the flooding, although a considerable quantity of grout and sand had entered the tunnel through the door, which was not securely closed, and through the 8-in. drain which had been left open. A bank of grout 12 ft. thick at the bulkhead, sloping to 12 in. thick 500 ft. south of the bulkhead, was found. The surface of this bank was in a plastic condition for a depth of 6 in. None of the material was set up hard, the subsequent removal being performed with pick and shovel. From the 8-in. drain clear water at the rate of 900 gal. per minute was flowing, and from a 3-in. cable conduit bulkhead there was a stream of 100 gal. per minute, neither being under pressure.

The construction of an emergency bulkhead about 60 ft. from the closed bulkhead was immediately begun. Simultaneously with the construction of this bulkhead the cleaning of the tunnel proceeded.

The method of procedure adopted for completely sealing the water flow of Oct.

5 consisted in driving a series of long test holes in an effort to pierce the fissure well outside the tunnel lines. The first hole drilled encountered water at full pressure at the computed depth of about 22 ft. The shorter holes were drilled with percussion drills and the long ones with diamond drills through the side walls of the tunnel close to the bulkhead.

The observation of results obtained in grouting was accomplished by the attachment of pressure gages on both the Bronx and Astoria bulkheads, and by allowing the pipes in the Bronx end to remain closed. Grouting began Dec. 18, and was followed immediately by the appearance of grout in the Bronx pipes, thus indicating that the point of injection communicated with the water hole of Oct. 5 and that the latter was still unsealed. On Dec. 19, after the ininjection of 3360 bags of cement, the hole finally refused.

It was quite apparent that the recent grouting had been effective, but during the time necessary to allow this to set a thorough investigation of the underlying rock was made by drilling ten long diamond-drill holes. The result was that although the rock structure outside the tunnel lines was found to be extremely disintegrated no water was encountered. On Jan. 5, 1914, the work of removing the grout fill between the bulkheads was begun. A small drift was driven through the Astoria bulkhead, after which the door was raised and the removal of the grout fill resumed. This work proceeded with very light blasting toward the Bronx bulkhead door, which was raised Jan. 15, and preparations were made for resuming the bench excavation after a delay of 102 days caused by flooding the tunnel.

UNUSUAL STRATIFICATION OF GROUT

In removing the grout fill it was found to be in an unusual condition of stratification. Some layers were extremely hard and others were equally soft. Some sections were highly stratified and others quite massive. Some layers and masses of what might be described as solidified "laitance" were found, which were as soft as chalk and had a curious chemical composition quite different from that of the original Portland cement. Layers of sand also extended through the mass, and in the vicinity of the water hole a 4-ft. blanket of coal, sand, shells, bits of wood, etc., was disclosed. No indications of water were apparent other than the usual normal seepage through the concrete lining.

Although the sum total of cement injected from both ends from the time of the flood to the completion of the grouting was only 595 cu. yd., about 1150 cu. yd. of solid grout was removed, in addition to 400 cu. yd. of débris, to say nothing of the quantity of cement grout which remained in and sealed the fissures themselves. The possible explanation of this is that in some manner the injected cement had mixed freely with very fine-grained decomposed dolomite, probably in suspension in the water, and that cement in the form of grout does not act as normal Portland cement does in maintaining a constant volume.

For removing the remaining stretch of bench a method of attack was devised which consisted of the construction of an inverted concrete arch over the remaining length of bench between bulkheads; an even more thorough exploration of the underlying rock with test holes as long as could be drilled; the injection of cement through these holes in an effort to solidify the rock mass, the inverted arch acting as a resistance to this grouting; the careful excavation of the exposed rock by very light blasting of small sections only, and the immediate concreting of the tunnel lining on completing a short length of full-section excavation.

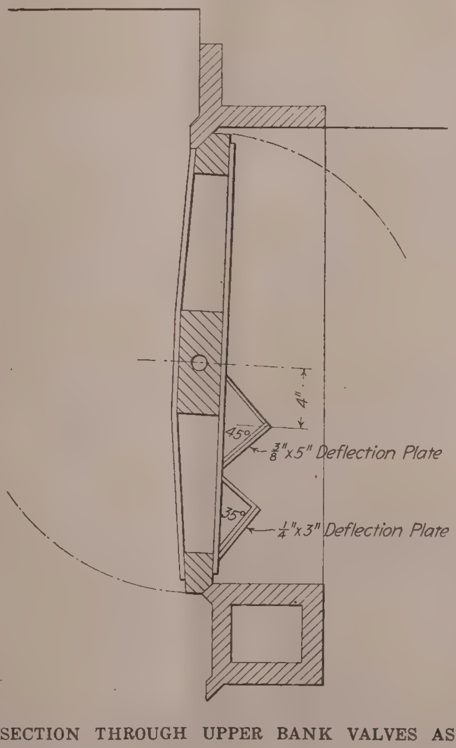
The inverted arch was 24 in. thick and 8½ ft. below the concrete tunnel arch on the center line. As this working space did not permit of drilling to the tunnel invert extrados, the exploration was accomplished by first testing to a depth of 5 or 6 ft. below the inverted arch. Drilling pits were then excavated and lined with concrete as an inverted arch well bonded into the tunnel arch and the inverted arch slab. The drilling was then continued from these pits, thus reaching well outside the necessary lines of excavation.

In removing this 122 ft. of bench, all the rock encountered was extremely wet, and although two flows of fair volume occurred, no unusual difficulties were experienced. On uncovering the water hole of Oct. 5 it was found to be a greensand seam, 24 in. wide and of unknown depth, filled with sand, coal, shells, etc., through which a 9-in. layer of hard grout extended. No water was flowing, nor was there any further trouble from this fissure.

Tests of Butterfly Valves Result in Modified Design

Report by Charles Keller Describes Experiments Made at U. S. Government Locks in Alabama —Deflection Plates to Be Added

AS A RESULT of experiments made on butterfly valves in the locks of the Black Warrior River in Alabama, the United States Government engineers have decided to modify the design of future valves and to add new deflection plates to all existing valves. Charles Keller, in the September-October *Professional Memoirs* of the Corps of Engineers, United States Army, describes these experiments and illustrates the results and the modifications mentioned.



SECTION THROUGH UPPER BANK VALVES AS ALTERED IN JUNE, 1912

Except two locks, which have cylindrical valves, all culverts on this Alabama waterway improvement are controlled by butterfly valves, either in pairs or in sets of three, operated by hand. Difficulty in operating three valves keyed to a single hand wheel led to the investigations. Two causes for this difficulty are apparent: Firstly, when two or more valves are operated simultaneously, water deflected from the first or upstream valve, when partly opened, comes into contact with and tends to close the second valve. The stream deflected from the latter offers a similar resistance to the opening of the valve next downstream. Secondly, the valve divides the stream moving into the valve opening, and the portion of the current downstream of the valve is deflected by the valve body. The eddy motion thus caused may produce a reverse pressure on the in-moving or downstream side of the back plate of the valve near the culvert floor, thus also tending to close the valve.

The retarding influence of one valve upon another has been overcome at some of the locks of 10 and 14-ft. lifts by installing steel partitions between the valve openings. At one lock with a 21-ft. lift reinforced-concrete partitions were provided during the construction.

In August, 1911, under the auspices of G. K. Little and H. C. Mower, assistant engineers, a series of tests were made to ascertain the effect of various arrangements of deflection plates applied to butterfly valves. As certain of these tests gave similar results, further tests were made in June, 1912, to permit a choice to be made between two arrangements of deflection surfaces. The head under which the latter tests were made averaged 6 ft.

MODIFICATIONS PROPOSED

As a result of all of the tests it was decided to add to all butterfly valves then in service, in addition to the 3-in. deflection plates originally provided, a second plate 5 in. wide secured to the back of each valve, with a horizontal angle of 45 deg. between them, and with the outer edge 4 in. upstream from the center line of the back plate, as shown in the accompanying figure. The valves of lock 16 (21-ft. lift), which had not yet been built, were designed to embody the same arrangement for deflection surfaces. This additional deflection plate, combined with the partitions between valves previously described, has made it possible for one operator to open to normal position the three valves of any set simultaneously and under full heads up to 21 ft.

The preceding account is derived from the records of the United States engineer office at Mobile. The experiments described are those referred to by H. C. Mower in *Professional Memoirs No.* 33, in which a general description of this improvement will be found.

INTEREST IN HIGHWAY IMPROVEMENTS in Louisiana is best shown, says W. E. Atkinson, State highway engineer, by the large number of public meetings to which the Highway Department has been requested to send a representative to discuss some phase of road improvement. Eagerness for individual information is also pointed out by the great number of inquiries.

Awakening the Engineer to Service Through Civic Responsibility

F. H. Newell Discusses Lines of Effort for Improving the Condition of the Profession—Thousands of Unaffiliated Engineers

ADDRESSING the American Association of Engineers on Sept. 14, F. H. Newell, head of civil engineering department, University of Illinois, made a strong appeal for greater co-operation of engineers in efforts to improve legitimately the condition of the profession through the assumption of greater responsibilities and the performance of greater service to the community. The material welfare of engineers can be promoted through several lines of activity, which are outlined in detail. Following are notes of the principal points made and suggestive facts cited:

THE ENGINEER MUST RENDER SERVICE

The quality which distinguishes the engineer as a professional man from his brother, the mechanic, is education. To be an engineer in the true sense one must have that education which enables him to understand the true perspective of things, to know the big from the little, to obtain facts and judge correctly from them. The education of the engineer, whether obtained through books or through things, has been largely at the expense of others—either society, the State or his more immediate employers. It is the recognition of duty to others which gives rise to the ethics of the engineering profession. The conception of engineering ethics is fundamental to the profession, and finds its highest expression in service—and service consists of those acts which tend to lessen trouble or increase the health, prosperity and convenience of others.

Engineers in performing service are by this very fact entitled to full recognition. Service implies a suitable reward, and while the effort may be altruistic, it does not involve unnecessary self-denial. A proper remuneration, one assuring a good living, is due the engineer. He who performs service rightfully does it with full expectation of reward, directly or indirectly, in the satisfaction of duty well done.

CONSERVATION AND ENGINEERING SERVICE

One of the more recent manifestations of this altruistic spirit has been in the so-called conservation movement — initiated largely by engineers—essentially an appeal to patriotism, characterized by love of mankind and having a deep religious significance. Other manifestations are in the rapidly increasing number of movements for civic betterment, for better farming, better schools and better homes made possible by the study of domestic economy. Among all the various occupations there is none which is more capable of leading in service to mankind and in realizing higher ideals than engineering.

The engineer should be a man of vision, a missionary of light and progress. His life is devoted to careful, impartial measurement and weighing of facts. He can not afford to be deceived or to mislead others on these facts; having ascertained them in their true proportion, it is then his business to idealize, to plan and to use his ingenuity in devising methods for adding to the comfort and convenience of mankind, such for example, as through better conditions of transportation, of communication, of heating, lighting, water supply and of the things which tend to produce better health and longer life in the community.

ENGINEER AHEAD OF PUBLIC

In this work, the engineer is far ahead of the public. The latter in many ways has not yet caught up with the growth of knowledge and does not appreciate the possibilities which are awaiting realization under the magic touch of the skilled engineer. Many a community is declining because it does not utilize the available water supply or have constructed the needed sewage system.

The public is not wholly to blame. The engineer is to a certain extent culpable. He has not fully felt the need of diffusion of information, except among his professional brothers. He has not taken the public into his confidence and explained in simple terms, in ways that would attract the public, the results already achieved, nor has he given these a setting or application such that the ordinary citizen and taxpayer can comprehend how this work affects him or how his condition may be improved.

OF 100,000 ENGINEERS, 40,000 ARE MEMBERS OF ORGANIZATIONS

Without attempting to discriminate very nicely between the different classes of men who may be considered as engineers, it is safe to assume that there are in North America more than 100,000 men whom we would class as "engineers," outside of the purely mechanical occupations. Of these, more than 40,000 are members of approximately 100 organizations. The greater part of this number is included in four great National societies, the membership of which in round numbers is as follows:

American Society of Civil Engineers	7,700
American Society of Mechanical Engineers	6,100
American Institute of Mining Engineers	5,000
American Institute of Electrical Engineers	7,750
	26,550

The above total of 26,550 includes many duplications, particularly of names of the more prominent engineers. It is safe to assume, however, that there are at least 20,000 engineers, embracing most of the men who have become leaders in the profession, included in the membership above noted.

The organizations next in point of size are the Engineers' Society of Western Pennsylvania, with headquarters at Pittsburgh (1150 members), and the Western Society of Engineers, with office in Chicago (1200 members). Next comes the Associated Engineering Societies of St. Louis with 800. The hundred or more local engineering societies organized at the principal centers of population have a membership each of from 100 or less up to 500 or more, averaging about 200, so that their total membership averages about 20,000.

YEARLY INFLUX AND OVERCROWDING

To this large body of engineers there is being added each year about 5000 recruits, mainly from the engineering colleges, more or less well trained in the fundamentals of engineering. There was a time within recent years when there was demand for every one of these young men in active engineering work. At present, however, it is necessary that many of them go into other lines. It is not to be supposed that their education is by any means wasted, as the training of a good engineering college is probably the most valuable to be had in preparing young men for their life work in lines of trade and commerce.

One of the problems that are now confronting us is the fact that each year this large group of graduates, as well as the thousands of young men employed in engineering offices, is coming into a profession apparently overcrowded. This overcrowding, however, is more apparent than real. Relief is to be obtained not by limiting the influx of men, but rather by widening the field of service.

UNLIMITED FIELDS AND OPPORTUNITIES

The field is practically unlimited, the bounds extending with every improvement in the conditions favorable to human health, comfort and industry. If every taxpayer and voter in the country, every town, city, county and State officer was fully aware of the conditions which surround him, and the extent to which the engineer could remedy or improve these conditions, there would be an immediate demand for all engineers who could be found.

Take, for example, the matter of road building. The public has been slowly educated toward the need of good roads, but not so fully to the fact that to build these good roads a certain amount of skill and experience is needed. We have the spectacle, surprising in a country which prides itself on its good sense, of millions of dollars being spent on new roads and in improving old roads, often without any preliminary survey or study of correct location or preparation of plans and estimates, or of adequate supervision of the work, even if well planned.

WASTE SHOULD BE AVOIDED

The amount of money which is being wasted to-day in the amateur efforts of elected officers, who will be replaced next year by men no better qualified, would furnish employment to a great part of the engineers in the country. The point to be observed, however, is not that we are arguing for the employment of these men, but that the claim is based upon the far more substantial grounds of benefit to the public and to the man who pays the bill.

The opportunities are boundless—they stand on every hand ready for us when we awake. Listen! opportunity speaks:

"They do me wrong who say I come
 no more
When once I knock and fail to find
 you in,
For every day I stand outside your
 door,
And bid you wake, and rise and
 fight and win!"

ART OF SALESMANSHIP NEEDED

The engineer, to succeed, must acquire the art of salesmanship. He may not recognize or label the quality and may even deny its existence. He points to the code of ethics rigidly observed against advertising or self-exploitation, and yet while conscientiously observing all proper rules of ethics, he may possess to a high degree the real art of presenting his wares in such a way as to convince the world that the general welfare is promoted by purchasing from him.

He has for sale, not boots and shoes, or legal opinions, but what is more difficult of delivery, ingenious but true ideals, imagination, trained by years of study and practice. He has acquired the power of making these "dreams come true." In proportion that the public or his employer recognizes these qualities, to that degree is he able to sell his wares.

There is perhaps nothing more instructive to the young engineer than to try to ascertain the methods of salesmanship which have led to the recognition of certain well known and respected engineers. Some have succeeded through or in spite of extreme modesty and a reticence which has been hard to break through; but in each case there has been not only true value of the goods to be delivered, but some quality of mind or action which has impressed upon others the fact that the goods are of superior value.

Suggested Lines for Action

In the present awakening innumerable schemes have been suggested for action, but most of these fall under one or another of two principal lines: First, co-ordination and co-operation of existing engineering societies and organizations; second,, formation of one or more new associations devoted almost exclusively to the material welfare of the engineers. These movements are the natural outgrowth of the discussion and unrest which have prevailed. They are not antagonistic and may be mutually helpful. Not all men think alike and the path which will be attractive to one group is not to another.

Summing up the needs and opportunities, it appears that a great part of the main body of engineers is not fully employed to the best advantages to society and to themselves, with corresponding loss to all. Nearly two-thirds of those who may properly call themselves engineers, or perhaps 60,000 men, are not members of any well-recognized organization, and are not utilizing their potential strength to help themselves or each other. There is need of enlightenment, of raising ideals and of united effort toward better things. The existing engineering organizations, which include perhaps 40,000 men, are devoted almost exclusively to technical questions as distinct from those things which concern the engineer as an individual and a citizen.

Few of the older societies attempt to bring in the rank and file of the profession, or attempt to cover the field of the new American Association of Engineers, in its efforts to help and reach the masses of the profession. The program already laid out by this association is founded on the solid basis of proposing primarily to raise the standard of ethics of the engineering profession and to protect the economical and social affairs of engineers.

The Results of Good Road Days in Pennsylvania, according to information received from W. R. D. Hall, statistician of the State Highway Department were as follows: Miles worked, 6008; men who gave their services, 82,393; teams employed, 14,858; drags used, 1859; and road machines in service, 83.

Time at Hand When the Engineering Society Should Awake to Its Deficiencies

Ernest McCullough States Before Western Society of Engineers That the Young Man Is Overlooked in Existing Technical Organizations

That the time has come when the engineering society should pause and consider whether it is doing a necessary work was the contention of Ernest McCullough, consulting engineer, in a paper presented Sept. 21 before the Western Society of Engineers. While he conceded that the earlier societies performed a valued service in that they brought together men having similar interests where papers were read and discussed by the older men, he charged the technical societies with not having developed with the work of the engineer, and with still lingering in the past and considering themselves as institutions organized solely for educational purposes. "This is the way they are conducted," said Mr. McCullough, "but the majority of the members know that many societies exist rather as an evidence of the standing of the members than for their declared purpose. The modern technical journal is doing far more real educational work than any society, no matter how large or how important it may be. The pages of the weekly and monthly papers bring to us news from the front fresh and in a way which the more formal papers of a society cannot."

Mr. McCullough's remarks were in part as follows:

Mutual Admiration Societies

"The young man feels he has not been paid the proper attention. There is a well-founded idea that engineering societies have for many years past been mutual admiration societies of successful men and used for the furthering of insidious advertising by men qualified to take full advantage of the position their membership brings them. The papers are generally obtained only by hard work on the part of the publication committee in each society. Many are hardly worth printing and would be rejected on merit by the average technical journal. The discussions are too frequently inadequate and real criticism is seldom developed when the author of the paper is of commanding eminence. Some men even use the society to which they belong for exploiting patented processes and materials. The young man learns something, but not much, from the papers, and feels diffident about discussing them, as he fears his opinion would not be well received. 'Get a reputation first,' is the attitude of too many authors when they write a closure to a discussion.

The Young Man Wants Fellowship

"The young man wants fellowship, companionship and definite recognition. He is glad to attend a meeting where he knows refreshments will be served, not because of the refreshments, but because something to eat and drink signifies a lack of formality and perhaps an opportunity to mingle freely with older men who have made their mark. He wants to make acquaintance with men having like interests with himself. He wants to feel that the society is more than an editorial body or compilation of engineering facts; that it is composed of flesh-and-blood men who want to help him because of their knowledge of the trials and tribulations he is undergoing. The older members have been over the ground and should help him. He would rather know how to obtain a position and how to hold it than hear how other men have done engineering work, for he reads the technical journals and gets a surfeit of such material.

Why Young Men Organize Societies

"From time to time young men organize societies which are intended to help them meet their particular troubles. These societies generally start out with the idea that every educated man should be kept at work, and the employment question is uppermost. They are generally organized as a protest against commercial agencies which obtain positions for technical men and charge large fees for putting the 'jobless man in touch with the manless job.' It is known that in many large offices the chief draftsman is a stockholder in such agencies and many discharged draftsmen think they are but pawns of fate in the hands of men who profit by their frequent changes in position.

"This year two such societies have been organized in Chicago. One is known as the Associated Technical Men, the other as the American Association of Engineers. Judging from my own mail I have no doubt all members of the Western Society have been regularly receiving printed matter from these societies. The aims and objects of the Associated Technical Men being too long to present in this paper, only the objects of the American Association of Engineers will be presented, for the two societies seem to be working toward the same end.

Aims of a New Organization

"The objects of the American Association of Engineers are to raise the standard of ethics of the engineering profession and to promote the economic and social welfare of engineers by affording means for the interchange of information; by maintaining a service clearing house; by affording patent and legal advice; by supervision of legislation; by proper publicity. Wherein do the objects of the association and of our own conflict? If there is no conflict, why is there such an association when there are several hundred technical societies already in operation in the United States?

"The answer is that the older societies are not attending to business. The work above outlined should be attended to by the veterans. 'Old men for counsel, young men for action,' should be the motto of the older societies. If this were the motto and lived up to properly the young men should obtain all the objects sought and the societies would grow faster than they are now growing. The members should receive the worth of their money; the older men in the feeling of satisfaction of following every worthy action, the young men in the experience of material benefit. In their turn the young members become old members and will pass the good work down to succeeding generations. Discussing the methods outlined by the American Association of Engineers the older societies can honestly say only the first has been attempted by engineers.

ENGINEER A WANDERER FROM JOB TO JOB

"That the second has not been properly attempted is a reproach. The engineer is a wanderer from job to job. When capital is active he is hard to find. When dull times come and capital rests, the streets are full of technically trained men out of work. They wander from office to office, many of them starving and too proud to admit it, many never getting a substantial footing. Their work is concerned with new enterprises, and with the day laborer they share the ups and downs of fortune, helpless and frightened when they face the facts. One of the most bitter things is the inability to explain their plight to their parents and families, for the popular idea of the engineer is that he is highly paid and always busy. There is a place for all and it is the duty of the older engineers to take care of these their brothers.

"Every day that the Western Society and the other large societies delay in organizing a service whereby members out of employment can be placed in positions is an inexcusable reproach. The organization is here; it requires only the spirit.

"The third method, namely, the affording of patent and legal advice, needs to be approached with care. The society should have an attorney who can help members who have trouble in collecting pay; that is, members who fall into the hands of unscrupulous employers. There are many such.

LEGISLATION THAT MEANS PROTECTION

"The fourth method is concerned with legislation for technical men. Not only must the modern engineering society see that legislation is secured to protect and elevate the enginering profession, but it must also carefully look after proposed legislation to the end that no laws will get on the statute books which work harm to the people of the State. That is, as citizens we must protect fellow citizens whose lack of knowledge of technical affairs leaves them at the mercy of special interests.

"The fifth method is proper publicity. The societies heretofore have concerned themselves with the publicity work of individuals. What is now a crying need is publicity work of a proper sort by the societies for the benefit of the membership, and, incidentally, of the technically educated men not members of any societies. Through proper publicity work all technical men not members will want to become members, Incidentally, the work of technical men will be so placed before the public that there will be an increase of good material in the ranks. Proper publicity should have the effect of sifting out desirable men from those not so desirable.

"Permit me to quote from a circular issued by the American Association of Engineers under date of Aug. 1:

" 'This association will be devoted to the best interests of the AVERAGE engineer of good standing, NOT to elevate the ALREADY ELEVATED, but to bring up the standing of the Rank and File to that attained in other professions. We solicit the support of the Big Engineer and Employers of Engineers and aim to command their respect through the above methods, and in the course of a little time (within your lifetime) secure the same standing for the Commercial Engineering Profession as that enjoyed by the Legal, Medical and Military Professions—Material Compensation, Consideration and Self-Respect.

" 'Why is the average graduate in Civil, Mechanical Electrical, Chemical or one of the dozen other engineering branches after five or ten years of labor in his chosen field still treated with the consideration given to day laborers and no recognition given to his part in the big commercial achievement resulting directly through his efforts?

" 'It is because there is no organized effort to show these results, and they are being usurped by others. These men (you and I) are so concentrated on the technical points of our daily labor that we overlook the big fundamental law that "he who does not speak for himself will be cursed by small praise." We must have a *Speaking Trumpet* for the Commoner. We need at least 5000 of the 100,000 men who are doing engineering work before we can expect to gain recognition.

MATTER THAT IS NOT NICE READING

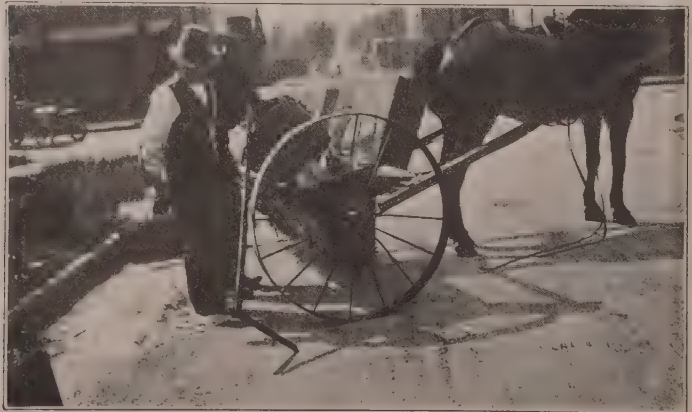
"Such printed matter distributed broadcast by young, energetic, well-educated men is a slap in the faces of the older men who attained standing in the days when competition was not so strong in technical work, and who fail to realize that the engineering graduate of to-day is up against it harder than were the men of the generation immediately preceding. This sort of printed matter is not nice reading, but it does represent the sentiments of thousands of young fellows who are earnest and are not yet anarchists or I. W. W. propagandists. It should waken all the older engineering societies so that improvements in conditions will come from the older men who have not forgotten the days of their own struggles. Let us help the men who want help before they have a grievance, for the nursing of a grievance, real or imaginary, is harmful to the souls of men.

"It is the duty of engineering societies to break away from precedent and get back to first principles. They must become again the places where the interests of the young men are the concern of the older men. They should not permit themselves to be classed as organizations for the elevation of the already elevated, but they should be *in loco parentis* to the rapidly increasing family of technical men. The work should not be done in a patronizing way, but should be regarded as something that should be done. It is not an opportunity which is faced by the Western Society. It is a duty.

" 'I hold every man a debtor to his profession, from which as men, of course, we seek to receive countenance and profit; so ought they of duty to endeavor themselves by way of amends to be a help and ornament thereof,' said Bacon. So as long as reproach can be brought that the societies do little more than print papers and discussions dealing with physical facts and neglect to consider men, the members are not ornaments to their profession. We must clear engineering of the charge that it is a most interesting profession but a mighty poor business."

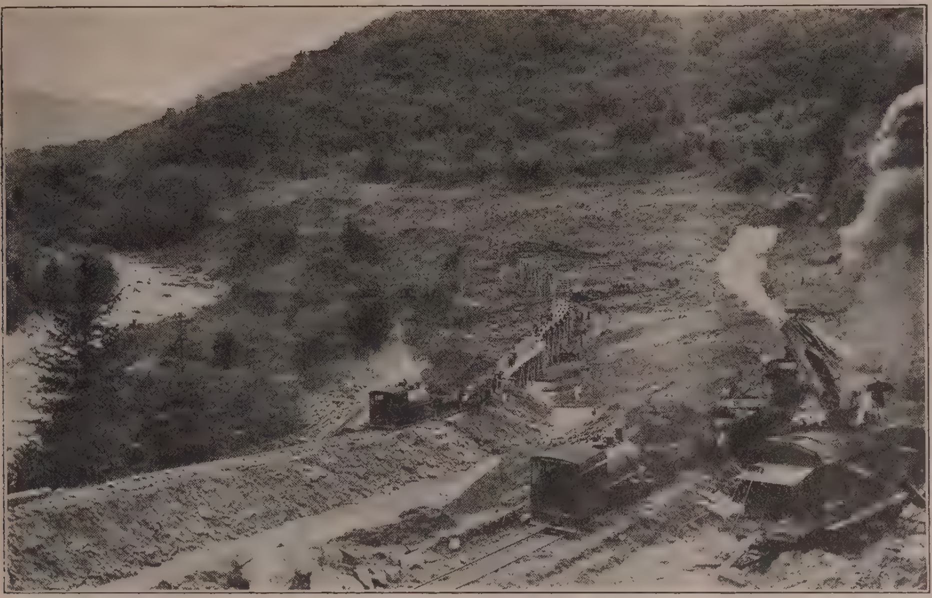
Gravel Roads Treated with Calcium Chloride as Dust Cure

CALCIUM chloride as a dust preventative has recently been given demonstration on 25 miles of gravel roads in Grand Rapids and vicinity by the highway commissioners of Kent County, Michigan. The chemical was placed on the road by a distributing machine, a grain seeder, which dropped about 1½ lb. to the square yard. It was found to be preferable to apply the calcium chloride in the afternoon to avoid heavy traffic and secure quicker and deeper penetration due to the cool, moist air of the evening. In order to prevent the chloride from being carried off and scattered by traffic it was not applied until the roads had been sprinkled with water or after a rain. When this rule was followed it remained where it was placed and traffic packed it into the ground, instead of picking it up on the wheels. Where there was more than ¼ in. of dust on the road it was swept or cleaned off. The chemical used by Kent County comes in 350-lb. drums from the Semet-Solvay Company, Syracuse.



FILLING CALCIUM CHLORIDE DISTRIBUTING MACHINE

ONE APPLICATION DOES AWAY WITH MUCH SPRINKLING



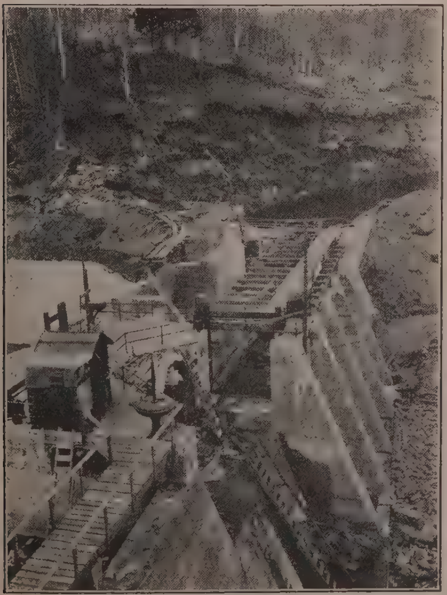
MATERIAL FOR CANAL EMBANKMENT EMPTIED FROM CARS ON TRESTLE

New Plant Marks Further Step in Development of Deerfield River, Massachusetts

Construction Costing Nearly $1,500,000 Completes Another Link in the Development of This River—Part II, Construction

TO THE construction department of the Power Construction Company fell the difficult task of carrying out the work, and this the department was asked to do in the short period of eight months. By conservative estimate this $1,500,000 job would ordinarily have taken two years to complete, yet the work was completed and the plant in operation within twenty days of the scheduled eight months. Moreover, the work was greatly handicapped by a heavy fall of snow and zero weather from the last half of November.

The work was located in as rough a territory as can be found in New England. It extended from Monroe Bridge village for about three miles downstream toward the town of Hoosac Tunnel, which in turn was three miles from the lower end of the work. At Monroe Bridge are located a paper mill and about a dozen dwellings. At Hoosac Tunnel are about the same number of dwellings. The first problem, therefore, was to build a camp and furnish a railroad connection for getting in equipment and materials. A camp site was chosen midway of the work and a large gang of carpenters set at work erecting buildings, the material being drawn in by teams.



DUNBAR BROOK STRUCTURE

It was at first planned to connect the only suitable site for railroad yards, shops and camp with the Hoosac Tunnel & Wilmington Railroad on the opposite side of the Deerfield Valley. The railroad was here some 50 ft., and the camp some 60 ft. above the river. This crossing was a matter involving a long-span bridge and trestles, requiring no small time and expense. Permission to connect with the railroad at this point was at first refused, and, not daring to delay, the company immediately started construction on a standard-gage supply road of its own from a siding it had previously constructed on the main line of the Boston & Maine Railroad at Hoosac Tunnel.

Supply Railroad

The valley is very narrow, with very steep rugged slopes on either side, and this, together with the fact that a railroad on one side of the river and a highway on the other already occupied the more desirable locations, made the construction rather difficult. There was much sidehill rock cut and trestle work. Even by using the maximum possible grades, the track was 60 ft. in elevation below the site of the conduit bench at the lower end of the work. As the first use of the road was to get in two steam shovels, a switchback was used to place the shovels on the conduit bench. The work on the railroad started April 27, and shovel 3 arrived at the surge tank June 9. Shovel 4 was moved in July 5. Meantime two steam shovels, dinkies, dump cars and other equipment were moved to the upper end of the work over the 110-ft. span steel highway bridge at Monroe Bridge, and the first shovel work was done on May 19.

To get supplies to the camp site and to the upper shovels in the shortest possible time a temporary standard-gage track followed shovel 3 along the conduit bench and up the line of the proposed canal. Thus the switchback line was used for getting in supplies until Aug. 9, when a lower level railroad was put into service. Then the temporary line along the conduit bench was used for the concrete mixing plant for building the conduit.

Although the supply railroad was only about 5 miles long from the camp to the Boston & Maine Railroad tracks as finally located, a total length of about 7 miles was built because of the necessary temporary locations along the job.

For facilitating the construction work this railroad proved to be of very material value and was considered to have justified its cost. The time of moving supplies to the job from the yard of the through Boston & Maine line was governed by the company rather than by a third road. The standard-gage track two-thirds the length of the work placed practically all the material at its destination with the minimum of handling, with a spur from the railroad across the valley to the camp only narrow-gage tracks would have been built from this point. The standard-gage equipment which could be used on much of the work was a material advantage. In addition to these advantages, the saving in freight charges amounted to a large sum.

Power Line Along Length of Job

One of the first moves when work started was to run a 2300-volt line the length of the job from plant 5. This furnished much of the power without the necessity of getting in large quantities of supplies for generating it.

The maximum force employed was about 1200. It is thought the attractive living conditions in the camp was a help in maintaining a plentiful supply of good labor throughout the job.

Up to Nov. 20 an exceptionally dry fall greatly aided the work and allowed the sidehill conduit work to be rushed to completion without a setback, whereas had heavy fall rains occurred at certain times the

PENSTOCKS ANCHORED IN CONCRETE

consequences might have been serious. From Nov. 20 to the completion of the work severe winter conditions existed, and the company was playing against heavy odds.

Considerable labor and material was saved by receiving the conduit hoop reinforcement in exact required length, bending to shape in a power bender and electrically butt-welding the ends. So far as known this is the first time this method of welding reinforcement in the field instead of lapping it has been used. It is interesting to note that by this method about 2½ ft. of steel was saved on each hoop, of which there were 10,000.

INTAKE AT MONROE BRIDGE

QUANTITIES INVOLVED

As an indication of the amount of work involved, the following quantities of the more important items are given: 750,000 cu. yd. of excavation, which included an excessive percentage of boulders requiring drilling and blasting; 24,000 cu. yd. of ledge rock excavation and 6000 cu. yd. of tunnel rock excavation, 620,000 cu. yd. of canal embankment and backfill, 23,700 cu. yd. of concrete, 1,260,000 lb. of reinforcing steel and the installation of three 7-ft. penstocks, 550 ft. long and three turbines.

All of the work except the placing and connecting up of the penstocks and turbines was done by the Power Construction Company under the direction of George W. Bunnel, president, assisted by those named last week in Part I.

Reclamation Service Opens Library on Its Projects

A LIBRARY of more than 500 volumes of histories, specifications, engineering investigations and cost data of the various reclamation projects under construction and being operated by the U. S. Reclamation Service has been assembled in the engineering section of the Washington (D. C.) office of the service. Many of the volumes are in manuscript and quite a few are illustrated with photographs. The library is unique in that in it may be found descriptions of the plans leading up to works, the actual construction, the cost of works and the settlement of project lands and operation. As far as possible the volumes are arranged alphabetically by State, and then by project.

Literature

For the Civil Engineer and Contractor

New Publications

American Road Builders' Association, proceedings of the Eleventh Annual Convention. Paper, 391 pages. Published by the association, 150 Nassau Street, New York City.

Official Handbook of the Panama Canal, 1915. Paper, 58 pages and map. Washington, Government Printing Office.

Gives much valuable information as to the operation of the canal, together with a brief review of the principal construction features.

Results of Experiments on Sewer Pipe and Drain Tile. By E. H. Beckstrand, professor of mechanical engineering, University of Utah. Bulletin 7, Utah Engineering Experiment Station. Paper; 6 x 9 in.; 52 pages; illustrated. Salt Lake City, State School of Mines, University of Utah.

Department of City Transit, Philadelphia. Annual report for year ending Dec. 31, 1914. Cloth, 322 pages; 91 maps; tables. Issued by the City of Philadelphia.

Two appendices are of particular interest, one giving condensed plans and profiles of the proposed subway and elevated lines, and the other describing the extensive traffic investigation made by the department prior to laying out the new lines.

Guidebook of the Western United States—Part D. The Shasta Route and Coast Line. By J. S. Diller and others. Bulletin 614, U. S. Geological Survey. Paper, 6 x 9 in.; 142 pages; illustrated. Washington, Superintendent of Documents.

This is Part D of the excellent popular guidebook issued by the U. S. Government and reviewed in the Engineering Record of July 17, page 85. It describes the Shasta and Western Coast line route (of the Southern Pacific Railroad) from Seattle to Los Angeles.

Value of the High-Pressure Steam Test of Portland Cements. By B. J. Wig, engineer physicist, and H. A. Davis, assistant engineer physicist, Bureau of Standards. Technologic Paper No. 47. Paper; 7 x 10 in.; 34 pages, illustrated. Washington, D. C., Government Printing Office.

Discusses the problem of an accelerated test for unsoundness of Portland cement and the various steam or autoclave tests proposed. The conclusions were printed in the Engineering Record of May 22, page 655.

Structural Steel Handbook. Cloth, 7 x 9 in.; 319 pages; illustrated. London, R. A. Skelton & Company's Handbook No. 16, $2.50 net. (75 cents to professional men under special conditions.)

Tables and notes containing much valuable information concerning English rolled sections. The general arrangement and the use of a thumb index greatly facilitates rapid and easy reference. In addition to the catalog of sections, new and useful notes, formulas, tables, diagrams, etc., are included, which are asserted to be authoritative and accurate.

Conference of Building Inspectors and Building Commissions of the United States and Canada.—Reported by J. G. Needham, official stenographer. Paper, 8 x 10½ in.; 115 pages; 7 plates. Brooklyn, N. Y., J. G. Needham, 1973 East Fourteenth Street. $4 per single copy, $3 each for five or more, $2.50 each for ten or more.

Record of the first Building Inspectors' Conference held in New York City May 14, as reported by the official stenographer and edited by those who took part in the discussion. Floor loads, hollow tile for walls, automatic sprinklers, inclosure of stairways and methods for the building official are discussed.

Effective Business Letters. By Edward Hall Gardner, assistant professor of English, University of Wisconsin. Cloth, 5½ x 7½ in.; 376 pages. New York, The Ronald Press Company. $2.

Engineers in executive positions will be particularly interested in this book, which contains in systematic form the principles involved in the best modern business letters. The following specific types of letters, which are discussed in detail, should prove of special value: Sales letters, adjustment letters, letters asking information, letters applying for positions and letters of recommendation.

Technologic Papers of the Bureau of Standards. S. W. Stratton, Director. Paper; 7 x 10 in. Washington, D. C., Government Printing Office.

No. 44—Investigation of the Durability of Cement Drain Tile in Alkali Soils. By R. J. Wig, engineer physicist, and G. M. Williams, assistant engineer physicist, in co-operation with others. Contains results of first year's tests. 56 pages, illustrated.

No. 48—An Air Analyzer for Determining the Fineness of Cement. By J. C. Pearson, assistant physicist, and W. H. Sligh, aid. 74 pages, illustrated.

Water Powers of Canada. Paper, 6½ x 9½ in. Ottawa, Canada, Dominion Water Power Branch, Department of the Interior.

The Maritime Provinces. By K. H. Smith, resident engineer. 34 pages, illustrated.

The Province of Quebec. By F. T. Kaelin, assistant engineer. 35 pages, illustrated.

The Prairie Provinces. By Percival M. Mitchell, consulting engineer, 78 pages, illustrated.

The Provinces of Ontario. By H. G. Acres, hydraulic engineer, 41 pages, illustrated.

The Provinces of British Columbia. By G. R. G. Conway, consulting engineer. 167 pages, illustrated.

The above set of five pamphlets has been prepared under the direction of J. B. Challies, superintendent of the Dominion Water Power Branch of the Department of the Interior, Canada, for distribution at the Panama-Pacific Exposition in connection with the Canadian water-power exhibit there installed. They are fully illustrated by excellent maps and photographs and describe the general hydroelectric and power situation in the various Provinces of Canada at the present time.

Books Reviewed

A City Manager

Author, H. A. Toulmin, Jr. Cloth, 5 x 8 in., 310 pages. New York, D. Appleton & Company. $1.50 net.

This book, beginning with an historical review of the city government in the United States, and a brief statement of conditions abroad, endeavors to show the position of the city-manager and commission form of municipal government in its proper place in the progress being made by municipal administration. The book, quite naturally, says little about results. It is too early yet to say the final word as to the success of the plan. Mr. Toulmin, a resident of Dayton, has made it—correctly so, this journal believes—a review of such meager results, from a year or two of operation, as are now available. Certainly all indications are that the plan will prove successful.

The book will prove of value to those who wish to know the details of organization under the city-manager plan. Each department is taken up in detail, and variations in the different cities which have adopted the scheme are pointed out. Arguments are given at length for and against the plan, the author drawing from many sources. An appendix contains a report on city government by commission made by the National Municipal League.

Practical Track Work

Author, Kenneth L. Van Auken. Cloth, 5½ x 8 in.; 216 pages; illustrated. Chicago, Railway Educational Press, Inc. $1.50.

This book does not pretend to be an engineering work, nor does it cover the general phases of maintenance of way. It is a nontechnical presentation of the problems of the track foreman and supervisor in the laying of tracks and switches, written largely from the author's own experience as track laborer and foreman. At the same time the author expresses the belief that the book will be useful to the young engineer in charge of track work, and the reviewer fully agrees with this opinion.

The author starts at the logical beginning —labor and organization—and the chapter on that subject embraces wages, housing, instruction, agencies and other phases of the problem. Then follows a chapter on material and tools, in which the author lays great stress on the importance of having good tools in good condition, and of handling material in such a way that economy in one operation is not offset by added expense in another. The next four chapters deal with tracklaying, and two more chapters follow on switches. A final chapter treats of surfacing new track. In these latter chapters alternative methods of doing the same thing are presented and compared, and the organization of forces for the different operations is discussed in detail. Considerable space is also devoted to various machinery for this sort of work.

An appendix contains an outline of a method of laying out curves with a 50-ft. tape, a 36-page glossary of terms, and twenty-two tables—not the familiar trigonometric and logarithmic tables, but simple tables of middle ordinates, switch data, superelevation on curves, and quantities of ties, bolts, spikes and the like in given amounts of track.

The book is written in simple English, with good clear type and plain illustrations, and is a useful addition to the none too abundant supply of American literature on track.

Manual of Surveying for Field and Office

Author, Raymond E. Davis, instructor in civil engineering, University of Illinois. Leather, 7 x 4 in., 395 pages, 54 illustrations. New York, McGraw-Hill Book Company, Inc. $2.50.

Reviewed by F. N. Menefee

Assistant Professor of Engineering Mechanics, University of Michigan, Ann Arbor, Mich.

Due to the nature and age of the subject very little actually new matter can be expected in a manual of surveying intended for students just entering a course. But without detracting from the service rendered the profession by books used in the past, improvement can almost always be looked for, in the matter of convenience, arrangement and general presentation. In looking over Mr. Davis' "Manual of Surveying for Field and Office," one is struck with the idea that he has kept a practical point of view in mind and has succeeded in working out a systematic method of presentation which will prove attractive and useful.

In each problem the object and procedure are clearly stated under separate heads and brought into the foreground with heavy type. These heads are followed by equally clear "Hints and Precautions" and "Practical Applications." The hints and precautions should keep the inexperienced from the usual run of mistakes and the practical applications will arouse the interest of that class of students who are prone to read parts of their texts superficially unless they know of the good use to which they may put the given problem.

The topics included are very complete; the figures easily understood and the cuts well chosen. Samples of notes are plentiful and large enough to be easily studied. The field work is closely co-ordinated with that of the office. The matter of clearly defining such terms as declination, azimuth, traverse, etc., has been overlooked and may invite criticism.

There are three pages well devoted to the relation between angles and distances and the precision necessary in reading angles corresponding to a required precision in distances. The text is followed by the usual tables. The index is complete and titled after the fashion of dictionaries, suggesting at a glance the contents of the pages.

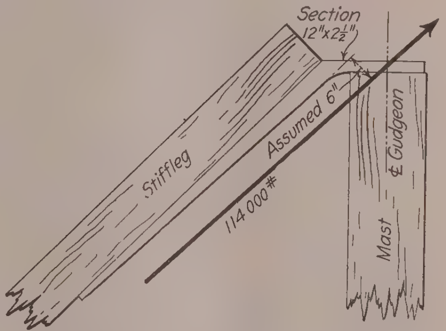
Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Strength of Gooseneck That Failed on Chicago Derrick

SIR: In your issue of Sept. 4, page 306, there is a description of the failure of a gooseneck in a derrick which was lifting a load of 21½ tons. It seems to me that an explanation of this accident is to be found in the common way in which goosenecks are designed, with reference to calculating the bending moment at the bend. Assuming a 50-ft. mast, a stiffleg at 45 deg., and the 118-ft. boom at 45 deg. in the plane of the stiffleg, the tension on the stiffleg when the boom was supporting 21½ tons appears to be about 114,000 lb.

This stress, however, acts on the gooseneck with a lever arm of at least 6 in., as shown in the accompanying sketch. This produces in the bend of the gooseneck a bending moment of 684,000 in.-lb. In the 12 x 2½-in. gooseneck this moment would produce an extreme fiber stress of 54,700 lb. per square inch. If the gooseneck were a tight fit on the gudgeon pin the latter might help it out by taking a part of the moment, but this would be a precarious thing to depend upon. Attention is called to it only as a possible explanation of why the gooseneck did not fail sooner. Excellent quality in the steel would not save for very long a piece of equipment subject to stresses like this.



GOOSENECK UNDER BENDING STRESS

The fact that the same derrick had lifted a load of 37 tons previously might be explained by supposing that the boom was at a higher angle, thus diminishing the stress in the stiffleg, or by supposing that the boom was not in the plane of either stiffleg, so that the stress was divided. Some things about the strength of equipment used for handling loads need closer analytic scrutiny than they are receiving.

EDWARD GODFREY.

Pittsburgh.

Dr. Imhoff Leaves German Trenches to Design Sewer Systems

SIR: We received on Sept. 3 a letter from Dr. Karl Imhoff, and knowing that many of your readers will be glad to hear from him I send you the following item:

Since last October his regiment has been in the trenches in western France. They were so well entrenched that there had been but little effective fighting and hardly any losses. Imhoff has devoted himself for eight months almost exclusively to military studies and training, and is in the best of health and sends kindest greetings to his American friends.

During this summer Germany has given her soldier officers on the western front liberal vacations. Dr. Imhoff was going off on leave of absence for six weeks. During this time he expected to complete his designs for the sewerage system of the Wupper district, including Elberfeld and Barmen, which he left unfinished when the war broke out. He is now about to return to his regiment.

From other sources I learn that the German Government has been building a large number of Imhoff tanks as a part of its general work of sanitation in the cities of Belgium and northern France occupied by the German army.

RUDOLPH HERING,
Consulting Engineer.

New York City.

Experiments to Determine Stresses in Parts of Rope Falls

SIR: I read with much interest the article on page 78 of the Engineering Record of July 17, by A. S. Beale, describing the lowering of a 79-ton derrick car from an elevated structure by its own power.

In analyzing the stress in the rigging used, Mr. Beale considers the load distribution among the various parts of the tackle due to the friction of sheaves and binding of the cable. He says, "The amount of increased stress in the standing part over that in the lead line was a matter of estimate, since up to the present nothing on the subject has been published." Not long ago we had occasion to calculate stresses in a somewhat similar tackle and found a formula taken from Weisbach's "Mechanics of Hoisting Machinery" that gives the efficiency of both fixed and moving pulleys. The efficiency of a fixed pulley is

$$\frac{1}{K} = \frac{1}{1 + C\,\frac{d^2}{r} + 2s\,\frac{P}{r}\,\sin L}$$

in which d = diameter of rope; r, effective radius from center of sheave to center of rope; P, radius of sheave pin; $2L$, arc of contact of rope on sheave; s, coefficient of friction (0.08); C, empirical constant.

The efficiency of a pulley moving up with a load is $(1 + K)/2K$, and the efficiency of a pulley lowering the load is $2/(1 + K)$.

For the value C in our problem we used $C = 1.8$, which is a value determined from experiments by the American Bridge Company, using ¾-in. wire rope. These experiments are described in the "Transactions" of the American Society of Civil Engineers of 1903, volume 71, page 161, and also in the Engineering Record of 1903, volume 48, page 307. The American Civil Engineer's Pocket Book also has a similar formula, and extracts from the American Bridge Company's experiments, on page 1225.

These experiments showed results that agree closely with the values calculated by the Weisbach formula. They determined a number of values for the constant *C*, depending on the size and material of the cable or rope used. However, only one value of *C* for wire rope, that for the ¾-in. size, was determined. It would seem that further experiments to determine the relation between the size of rope and the value of *C* would be of much value to the profession. C. S. ADAMS.

Douglas, Ariz.

Sloping Versus Curved Crowns for Highways

SIR: Mr. Farley's letter on "Sloping Versus Curved Crowns for Highways" in your issue of Aug. 7, page 174, I have read with interest. I agree with him in favor of the sloping crown.

A month ago I took an auto trip to Lake Erie over the Ohio roads from here to Warren, Ohio, and from there to Geneva. Some of the "dirt" roads in this section have such excessive curved crowns that it was all I could do to keep my car from going into the ditch when turning off the middle of the road to let another car pass. And the road was not wet. Of course, some will say that this would happen on a sloping as well as on a curved road, but I claim it would not near as much. There is also the advantage, as stated by Mr. Farley, in the sloped road in being able to use the road grader or drag, finishing at one operation.

I am very much opposed to a high crown, the disadvantages being as above stated. The crown should be just enough to let the water run off—about ¼ in. fall per foot on a paved surface and ½ in. on a dirt surface.

In connection with this, it might be well to say that many of our dirt roads could be kept in good condition by using a log drag just after a rain. Instead of doing this, some simple-minded supervisor on a road which I passed over this summer had thrown the dirt and grass from the ditches into the ruts. Surely, the fools are not all dead yet!

The above is about on a par with the State Highway Department of our State a few years ago (in 1912, for example), who built "waterbound macadam" on our Alleghany Mountain highways. I must say to the credit of the present administration, however, that I do not believe they are doing that now. The above highway, of course, at the first heavy rain, washed out; "and the end of it was worse than the beginning." A. E. DUCKHAM,

Pittsburgh. Consulting Engineer.

Curved Overhang Suggested for Galveston Sea-Wall

SIR: I have read the editorial and two articles on the Galveston storm in the Engineering Record of Aug. 28.

Your remark, on page 247, that "there is an opportunity for profitable study in what might be termed a secondary line of defense along the waterfront, some provision for holding back water blown inland from the sea-wall" is correctly suggested, but would it not be in order to prevent the heaviest of the water blown in from falling on the city side of the wall? I know of sea-walls that materially reduce this trouble, and it can be minimized, though not altogether averted under such extraordinary conditions as those at Galveston, by carrying the wall (see profile, page 274) about 4 ft. higher, vertically, on the back, but on the front (sea side) commence a curve at the existing top and curve outward in a uniform circular arc, until, at the 4-ft. superelevation, it has a 1½-ft. overhang from the existing face. This would make the width of the parapet on top 5 + 1½ = 6½ ft. This parapet should be made in one solid monolith, securely anchored to the top of the existing wall, for the overturning force will be tremendous. This will throw the wave mass *outward*, and while some of it will be blown inside the back of the wall, it will be mostly spray. The curve now in front is exactly adapted to cause the damage that occurred.

The most important work now needed to be done is to raise the channel, or port, side of the city about 10 ft. to get it above, not the tidal wave, but the bay wave, when the wind, as it generally does, whips into the north and drives the waters piled up in the bay (which has an area of 271 sq. mi.) against the "waterfront," not "sea front," while the great gulf swell is still coming in against this wave from the bay. This work was proposed, I understand, at the time the sea-wall was built, but evidently the great cost of raising the whole waterfront of the city staggered the financial source, and it was left to good luck to save the city from inundation from that side.

As to the sea-wall it is a splendid engineering and constructive work. I do not criticize it. It has proved itself adequate to withstand the shock of a hurricane which struck it fair and square. My suggestion looks to mitigation of the disaster along the boulevard back of it, and to do on the waterfront, by a wall or ramp, what was originally intended.

E. L. CORTHELL,
Consulting Engineer.

North Egremont, Mass.

New Concrete Elevator at Galveston Withstood Hurricane

SIR: We are sending you a photograph that may possibly be of interest—a large concrete grain elevator completed at Galveston, Tex., in June of this year, and erected by the Southern Pacific to replace a wooden elevator that was burned late in 1914. The builders were James Stewart & Company. Although it was feared that tall buildings would be demolished during the recent Galveston hurricane, we learn that this building came through the storm in fine shape with no injury except that the window glass was smashed by flying débris.

THIS NEW ELEVATOR AT GALVESTON WITHSTOOD THE RECENT STORM

The basement was flooded with sea water, but this seems to have done no harm. Naturally we are pleased that this happens to be an Alpha cement structure.

S. ROLAND HALL,
Advertising Manager, Alpha Portland Cement Company.

Easton, Pa.

TIMBER LANDS IN THE CHUGACH NATIONAL FOREST IN ALASKA, amounting to 5,802,000 acres, or about half the total area of the tract, have been returned to the public domain by a proclamation recently signed by President Wilson. The timber effected is located in three large tracts: one along the entire southerly slope of the Chugach Mountains, the second lying northeast of Seward, between Resurrection Bay and Kings Bay, and the third, northwest of the Kenai Mountains in the region around Tustamena and Skilak Lakes. These areas, which are to be crossed by the Government railroad, do not include the better grade of timber. The Alaskan Engineering Commission has been authorized to cut 85,000,000 ft. b.m. of timber for use in constructing the Government railroad.

HINTS FOR THE CONTRACTOR

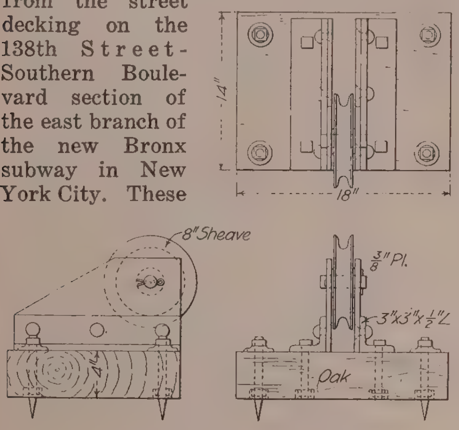
Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Device Helps Auto Truck Remove Chutes Through Street Decking

A SHEAVE mounted on a 4-in. plank in the corners of which are four spikes to keep it from sliding has been rigged to save labor in removing vertical chutes hung from the street decking on the 138th Street-Southern Boulevard section of the east branch of the new Bronx subway in New York City. These chutes, which are made of 5-ft., telescoping, circular sections, were formerly pulled up with much heaving and strong language by a full crew of laborers hauling on a rope attached to the bottom section of spout. The chutes nest about one foot, which makes them stiff enough to come up as a column, the sections being detached at the top as they come above the decking. A foreman got the idea of hitching the rope onto one of the auto trucks instead of pulling the chutes out by hand, and tried it with success. H. R. Shailer, general superintendent of the Richard Carvel Company, Inc., the contractors, witnessing the destruction of good manila rope caused by this practice of using the rough edge of the hole in the decking as a sheave, had this simple device built.



SPIKES PREVENT SLIDING

In operation the block carrying the sheave is set on the decking at the hole through which the chutes are to be raised. A ¾-in. manila rope is dropped down the hole, tied around the bottom of the chutes, laid over the sheave and the upper end tied to an auto truck. As the truck takes a strain the spikes in the device bite into the wood decking and prevent its slipping. As the truck moves the chutes rise up out of the hole, guided by two men, who keep them from fouling and detach the sections as they come up. The device is said to work very well, and much time has been saved by this method in moving these drop chutes from place to place.

Oiled Roads Quickly Sanded by Whirling Disk on Motor Truck

BY attaching to the rear of a motor truck a hopper which feeds onto a circular plate rotated by bevel gears and a chain and sprocket drive from the rear axle of the machine, the cost of spreading sand on freshly oiled roads has been reduced at Victoria, B. C. The accompanying photographs, received from Charles H. Rust, city engineer, show how the device is operated. Shovelers stationed in the body of the truck keep the hopper filled with sand and the rate of flow may be controlled at the bottom opening by a sliding plate.

The wrought-iron whirling plate is 30 in. in diameter and is divided into four sectors by angle-iron plates forming vertical, radial ridges which, as the plate revolves, act in the same way as the vanes of a centrifugal pump and cast the sand outward upon the road surface in the form of an evenly distributed shower. The sprinkler will spread sand over a 10-ft. width of roadway. When the truck travels at the rate of 3 miles per hour the disk rotates at a speed of 285 r.p.m.

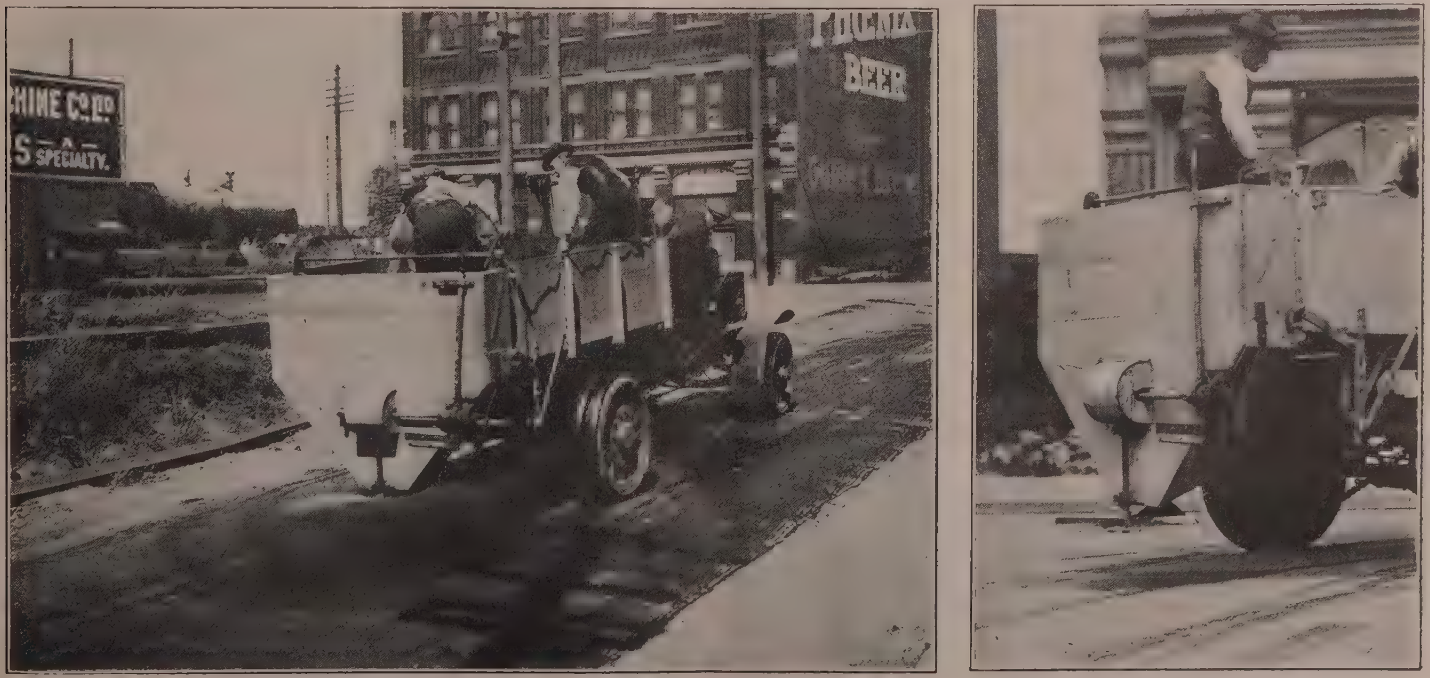
Buggy Bodies Mounted on Truck Fill the Bill as Concrete Car

By F. C. JEWETT

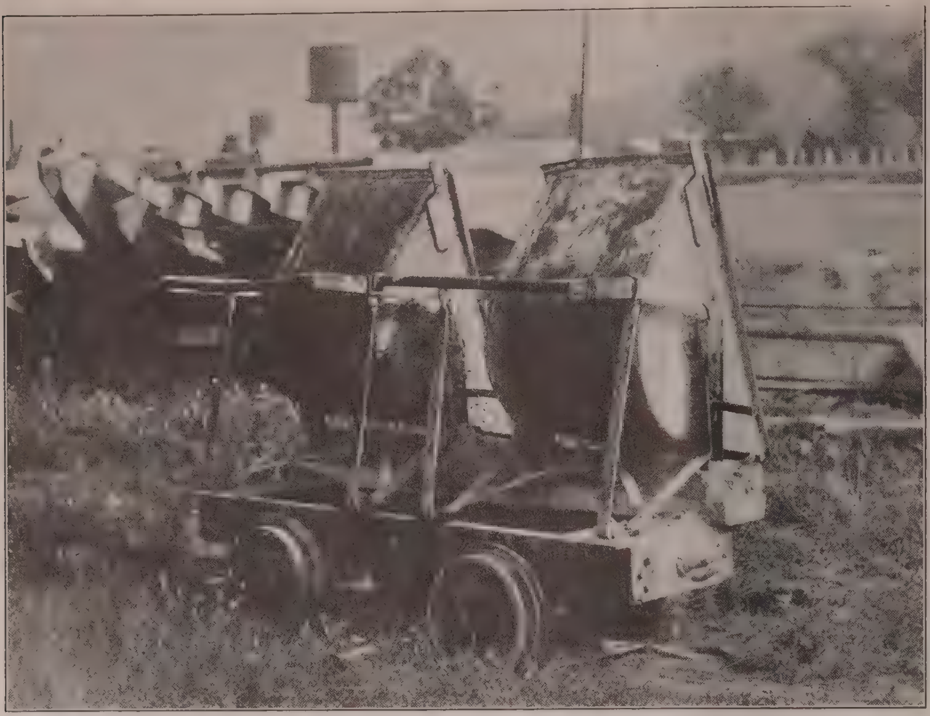
Superintendent, Quinlan & Robertson, Ltd., Campbellford, Ont.

A SIDE-DUMPING concrete car of requisite capacity which would pass clearance limits that were too narrow for an ordinary concrete car of the same capacity is shown in the accompanying photograph. This home-made car was used in concreting a 100-ft. gap left in a retaining wall along the Trent River at Campbellford, Ont. Part of the contract on this section of the Trent canal consisted of building a concrete wall on each side of the Trent River, which is here used as the canal. Near the south end of the town the river is crossed by a bridge belonging to the Grand Trunk Railway. The approach on the east side of this bridge is an earth fill about 35 ft. high, the top of which is approximately 10 ft. higher than the top of the wall.

The walls were first completed, leaving out a short section of the east wall about 100 ft. long through this embankment. Last February three rows of piles were driven on each side of the location of the wall in the embankment by a track pile-



SAND SPRINKLER, RUN BY THE MOTOR OF THE TRUCK, SPREADS AN EVEN LAYER OF SAND AT LOW COST ON REPAIR WORK



CLOSE-QUARTERS DUMP CAR MADE ON THE JOB FROM BUGGIES AND TRUCK

driver. These were capped and decked to carry the railway of track while the section of the wall was being finished. The excavation for the wall between these bents was then made, using heavy cross-braces. On account of the cold winter weather the sides of this cut gave no trouble, but stood up straight.

To concrete this section of wall a Smith hand mixer was set up on the backfill behind the end of the completed wall north of the railway embankment, where gravel could be easily delivered by teams. The mixer was blocked up about 3 ft. so as to dump into the distributing car. This car was made by bolting two concrete buggies, from which the wheels had been removed, side by side on a long, light four-wheel truck of 24-in. gage that had formerly been used in the machine shop. A track was built from the mixer along the section of wall level with the top of the forms. This was located so that the buggies dumped directly into the form, which was only 3 ft. wide at the top.

One man could handle the car, dump the concrete and make the round trip with little delay to the mixing, although on the longer runs an additional man was put on to speed things up. On each trip the car took four or five batches in the two buggies. In this way an average of 32 cu. yd. was placed per 10-hr. day. With this car no concrete was slopped outside the forms, as would have been the case with wheelbarrows or buggies, and the carpenters were able to work under the track whenever necessary without inconvenience. A standard concrete car of the same capacity would not have had sufficient clearance to operate under the railroad track.

The contractors for this section are Quinlan & Robertson, Ltd., for whom the writer had charge of the work.

Special Equipment to Cast and Handle Large Concrete Blocks

THE SEVEN-TON "strong back," as the special grapple shown in one of the accompanying views is called on the job, is being used to handle 60-ton cellular concrete blocks in the casting and storage yards of Foley Bros., Welch, Stewart & Farquier, who are building the new Ocean Terminals at Halifax, N. S. The other illustration shows one of the blocks being poured and another being finished. These blocks are cast in a large yard with concrete made in the central mixing plant shown in the photographs. Collapsible steel forms are used. When hardened, the blocks are loaded on cars by the 150-ton Industrial crane and either stored or sent to the water front. Here they are to be laid up in a wall more than a mile long, comprising a quay wall, a 1250-ft. pier and two steamship basins. The blocks will be laid on a level bed-rock-and-concrete foundation prepared by a large diving bell. They are to be laid up to the coping of the wall, and then the open cells will be filled with reinforced concrete, bonding the blocks into a continuous wall. L. G. Fuller is superintendent of the work for the contractors.

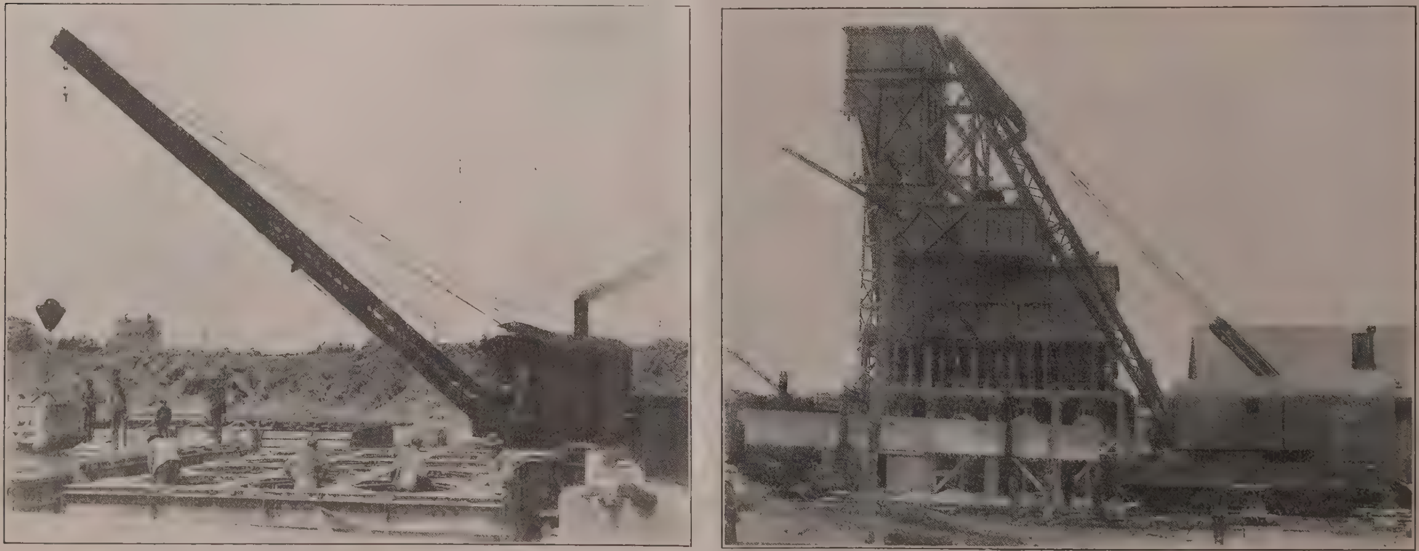
Dynamite Placed in Canvas Ring Cuts Cylinder Pier Off Smooth

SOME 3-ft. concrete cylinder piers with ½-in. sheet steel shells were recently cut off smooth below water by placing a charge of dynamite around each in a canvas collar, sunk to the level of the mud bottom.

A condition of the job, according to the *Du Pont Magazine,* was that the break at the mud line, 8 ft. under water, should be a smooth one. The first attempt was made by placing three charges of dynamite in twenty-four holes drilled into the pier at the mud line in three groups of eight holes each. This charge cut off the pier, but left a jagged top.

Mr. Bolger, who was in charge of the blasting, then made a canvas pocket of 2-in. diameter, a little more than 10 ft. long. This was loaded full with sticks of dynamite, tied around the next pier as a collar, and slid down to the mud line. When the shot was fired the pier cracked off level with the mud, leaving a surface almost as smooth as a saw cut.

METALLIC TIN is now mined in Alaska. According to the U. S. Geological Survey 526 tons, valued at $380,000, were produced there in 1914. The ore is reduced in Wales, at Singapore, and, very recently, at Seattle.



LEFT, CASTING BLOCKS IN YARD—RIGHT, GIANT CRANE WITH 58-TON BLOCK IN FRONT OF MAIN MIXING PLANT

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Rock Slide Causes Second Collapse of Subway Decking

One Life Lost in Accident at Broadway and 38th Street, New York City—Steel Set in Collapsed Seventh Avenue Section

A slide of schist from the west wall of the subway cut on Broadway just above Thirty-eighth Street, New York City, at about 7.30 p. m. on Sept. 25, carried away the posts supporting the decking on that side of the street for about 50 ft. in the rear of the needlebeams at the heading, causing that half of the roadway to fall into the cut, and the two street-car tracks and the other half of the roadway to sag. An empty taxicab, standing directly over the slide, and three pedestrians, one of whom, a woman, was killed, fell into the hole. A workman below was also injured. A street car which was on the edge of the sagged section of the tracks was backed to safety by its motorman.

Decking Stands Up Well

Contrary to what occurred in the total collapse on Seventh Avenue on Sept. 22, the Broadway decking behaved exactly as might have been predicted. That part from beneath which the posts were swept fell in, and the rest stood up very well, with a little sagging in the immediate vicinity of the gap. This section is under construction by the U. S. Realty & Improvement Company, on whose work the Seventh Avenue accident happened. The same type of street support as gave way on Seventh Avenue was used in the Broadway cut. The behavior of the Broadway construction is thought to indicate that there is nothing radically wrong with the system of supporting the street used on the two sections. The rock slide acted across the cut, whereas rock hurled from a blast in the heading would act in line with the cut; but the slide at Thirty-eighth Street took out enough posts to demonstrate that the strength of this type of street support under accident conditions is by no means inconsiderable.

Concealed Cracks Cause Slide

The rock at Thirty-eighth Street and for some distance south is a partly-weathered micaceous schist, the treacherous character of which has been well known since the Pennsylvania tunnels were driven through it under Thirty-third Street some time ago. On this account great care has been taken to underpin all buildings along this part of Broadway to subgrade of the new subway. The strike of this formation at Thirty-eighth Street is approximately parallel to Broadway, while the dip is more than 60 deg. to the west. Fearing cleavage planes along the dip, the engineers had carefully watched the east side of this section for signs of a slide. A crack here would have shown in the cut; but the almost vertical cracks which the slide on the other side shows to have existed under the west sidewalk above Thirty-eight Street were not apparent, either under the sidewalk or in the short crosscut at Thirty-eighth Street, when examinations of this side of the excavation were made on Sept. 23 and 24 by engineers of the Public Service Commission and the contractor. Cross-sections of the cut show that the west face, prior to the collapse, was practically vertical.

Noted Engineers Called In

Henry H. Quimby, chief engineer of the Philadelphia Department of City Transit, came to New York on Sept. 23 to look at the collapse on Seventh Avenue. The New York Public Service Commission instructed Alfred

(*Continued on page* 430, *third column*)

Animated Discussion on Wide Range of Subjects Marks Concluding Sessions of International Engineering Congress

Irrigation Held to Be a Human Problem—State Supervision Suggested—Experts Discuss Flood Prevention, Dams and Waterways—Trend of Development Indicated by Opinions on Bridge Building—Technical Education Should Be Broad—Municipal Engineers Condemn Pavement Cuts

So far as the civil engineering membership of the Congress was concerned hydroelectric development, railway electrification and irrigation were the outstanding features of the latter half of the International Engineering Congress in San Francisco which ended last week. These subjects naturally engaged the attention of a great many engineers on the Pacific Coast. The discussions were lively, varied and valuable.

Irrigation

Irrigation was discussed at four sessions, the first being devoted to a general consideration of its economic advisability. Throughout the discussions there was insistence upon the human and economic, rather than the engineering, aspect of the subject. A number of the speakers expressed the belief that in this country we would shortly be forced to assist settlers by building houses for them and selling them equipment on time. In support of this policy there were cited the experiences of Australia, Italy, Spain, and of the Canadian Pacific Railway.

It was pointed out by several speakers that men, inexperienced in irrigation farming, were allowed to go on projects, with the inevitable result. Unfortunately, too, these men have been lead into the belief that irrigation farming offered large and certain profits. The proper procedure is to develop a large project unit by unit, not taking up a new section until the previous ones are settled and in service. G. N. Houston of Calgary pointed out that in sections where irrigation is not an absolute necessity, but is resorted to merely for the purpose of increasing crops, the settler with insufficient capital will not go to the expense of preparing his land for water but will continue to use dry farming methods.

State Supervision

At one of the later sessions Prof. Charles D. Marx of Palo Alto and Major P. M. Norboe of Sacramento related the efforts made in California to secure State supervision of private irrigation enterprises in much the same manner as the railroad commission supervises the finances and operation of public utilities. Under the present State law plans for projects are submitted to the State authorities but no machinery or funds are available to insure the execution of the works in accordance with the approved plans. The object, of course, is to give standing to the securities of irrigation companies but that object cannot be attained under present legislation. Efforts are to be made to secure the passage of an adequate act in the near future.

Underground waters as irrigation supplies came in for considerable discussion, prompted by the paper of G. E. P. Smith of Tucson on that subject. Charles H. Lee of Los Angeles strongly advocated legal control of ground water in somewhat the same fashion as surface supplies are controlled by the State. Other speakers, including J. C. Nagle of Austin, Tex., and Major Norboe indorsed Mr. Lee's position.

Duty of Water

The discussion of the duty of water brought out clearly that averages for water application to various crops are entirely untrustworthy, the requirements for any given crop varying

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Assail Ferris Bill at Water Power Conference

Heated Debate Centers on State Versus Federal Control of Western Resources

As a result of the Western States Water Power Conference held in Portland, Ore., last week resolutions were adopted by the delegates on Thursday, Sept. 23, strongly urging the contention of State rights as opposed to governmental control and contending that the Western States are fully capable of dealing with water-power legislation themselves. Many of the States object strongly to the Ferris bill.

The resolution specifically called for a declaration from Congress recognizing and acknowledging that the interest of the United States in the public lands should be subject to the jurisdiction and eminent domain of the States in which the lands are located. It was contended by the delegates that the State ownership of the water was far more valuable than the federal government's ownership of the land, and that the States could handle the situation from that viewpoint.

The conference was the direct result of a resolution passed by the Oregon Legislature in the spring of this year calling for a conference of delegates from Western public-land States. In consequence, fourteen Western States appointed delegates, and of these fourteen States all but South Dakota and New Mexico were represented at the convention.

The first two days of the conference were spent largely in listening to addresses by well-known officials and utility operators. The position of the government was outlined by Messrs. Tallman, Graves and Merrill, and Senator Chamberlain of Oregon stoutly upheld the merits of the Ferris bill. Messrs. Dawson, Piles, Roemer and Ralston spoke in favor of a logical conservation that would permit development of the country's resources on an economical basis.

Water-Power Franchises

In discussing the terms of federal water-power franchises John H. Roemer recommended the indeterminate permit with an initial fixed period of fifty years. He suggested that an independent tribunal, such as the Interstate Commerce Commission, be intrusted with the administrative features of such legislation.

"Unless Congress will recognize the fact that men of affairs will not engage in any undertaking where they must suffer restrictions and bear burdens to which others engaged in the same business are not subject," Mr. Roemer declared, "it would be better to allow the existing laws to remain, with perhaps an amendment negativing the power of any public official

(*Continued on page* 432, *first column*)

greatly in different localities, depending upon slope and location of the land, rate of evaporation and plant transpiration, etc. For example, alfalfa in some sections of Arizona requires only 1 acre-foot while in others 6 acre-feet are needed. In this connection, too, attention was called to the effect of temperature of water upon production, snow water supplies tending to give lower yields than warmer sources under the same soil and climatic conditions. Most of the speakers who joined in the discussion emphasized the need for careful studies of duty under different conditions and then the practical application of the data determined.

Flood Prevention

In the session on flood prevention there was much highly technical discussion on the regimen of rivers in alluvial and glacial valleys and also upon the cycle which a river system goes through in order to regain stable conditions when a by-pass has been formed. In explaining the solution of the Sacramento Valley problem C. E. Grunsky said that it consisted essentially in making the stream carry all the flow possible by the highest practicable levee and then letting the surplus go into the natural basins in the valley through the by-passes. Abraham Gideon of Manila told about a flood of 40,000 sec.-ft. in the Pasig River, which has a normal flow of 6000 sec.-ft. One of the tributaries alone during that flood carried 65,000 sec.-ft. from a drainage area of only 100 sq. miles, while the total watershed is 300 sq. miles. On examination it was found that the surplus waters had backed from this tributary into a large lake which thus served as a retention reservoir. Had this not been available the water in the city of Manila would have been 15 to 18 ft. deep. Moreover, due to the lake, the high water lasted for several days.

Dams

In discussing the paper on dams, prepared by Arthur P. Davis and D. C. Henny, John S. Eastwood of San Francisco stated that the multiple-arch dam does not come into its own until fairly good heights are reached. He was of the opinion, too, that the earth dam can compete with the multiple-arch dam only when hydraulic sluicing is possible. In his judgment there would be no trouble in carrying a multiple-arch dam to a height of 200 ft. and at a lower cost than for any other type. Gardner S. Williams of Ann Arbor, Mich., on the other hand, referring to the multiple type of arch dam built under his direction in Michigan and Wisconsin, felt that their province was mainly for the lower structures.

Waterways

In the session on waterways Col. C. McD. Townsend, discussing Col. C. S. Riché's paper on inside route waterways, stated that the intracoastal waterway is illogical as a transportation route for through freight. The cheapest transportation in the world is by ocean steamships. A Mississippi River packet, for example, burns thirty-eight times as much coal per ton-mile as a large lake freighter with a speed of 12 miles per hour. Insurance rates, too, are higher on inland waters. On the Mississippi they exceed 10 per cent; consequently, few vessels are insured. In a thinly settled region, Colonel Townsend believed, where railroads must charge 1 cent per ton-mile a canal may compete as a freight carrier, but in a thickly settled region where the railroad charges are three to four mills per ton-mile a small canal cannot compete successfully.

In discussing the commerce on the River Rhine, Colonel Townsend pointed out that in 1883 the Rhine commerce amounted to 3,800,000 tons while that of the Mississippi passing St. Louis was 2,000,000 tons. In 1913 the commerce of the Mississippi past St. Louis had not increased, but that of the Rhine had reached 28,000,000 tons. The figures for the Mississippi, of course, do not include the commerce coming down the Ohio, which enters the Mississippi at Cairo.

Railway Bridges

Railway bridges came in for discussion following the paper by J. E. Greiner of Baltimore on that subject. Prof. Charles Derleth, Jr., of Berkeley, expressed the view that more and more, where cost will permit, masonry bridges will be used where short spans are possible. In trusses the tendency is in the direction of solid floor systems. He believed it a wrong tendency to propose completely continuous spans for long-span work unless the piers are on rock so that there will be no settlement. In regard to computations, he was of the opinion that more and more they should be left to experts who do practically nothing else, always, of course, in consultation with the engineers responsible for the project.

Prof. Charles B. Wing of Palo Alto emphasized that the bulk of the bridge building is in the short spans, and that to effect large economics careful study should be given types adapted for use in the smaller structures. He believed that for the western part of the United States there is still much warrant for the use of timber deck type trestles. The type used on the Southern Pacific has an asphalt deck-covering that protects the structure from water.

Commenting further on the Southern Pacific's type of trestle, William Hood, chief engineer, explained that his company used untreated timber, except for the guard rails which are exposed to rain and to the more destructive agent, the fierce Western sun.

Fire Protection

In discussing John R. Freeman's paper on fire protection, T. W. Ransom, mechanical engineer in the city engineer's office, San Francisco, thought that there was danger in going too far with high-pressure fire systems. They are applicable, he stated, only in the larger cities. High-pressure streams require large, trained departments, while 75 lb. is high enough for the smaller cities.

Public Utilities

On the subject of utilities there was sharp disagreement with the anti-municipal ownership views of Dr A. C. Humphreys of New York. M. M. O'Shaughnessy city engineer of San Francisco; T. W. Ransom, of Mr. O'Shaughnessy's staff, and A. H. Dimock, city engineer of Seattle, contended that with proper personnel and the utilities removed from politics municipal plants can be operated economically and with advantage to the people. Mr. Dimock cited the drop in power rates in Seattle from 20 to 6 cents a kilowatt-hour as a result of the city's entry into the power field. M. H. Brinkley, of the California Railroad Commission, also dissenting from Dr. Humphrey's views, declared that cities should be allowed to work out their own problems, adopting municipal ownership if the majority believed it of advantage to the city. He believed that public ownership was the ultimate solution of the utility problem.

Technical Education

Discussion of the papers of Prof. George F. Swain, of Harvard, and President Ira N. Hollis of Worcester Polytechnic Institute on technical education was mainly to the effect that we have carried specialization too far, that we seek rather to give a mass of facts than to develop the thinking power of the students.

Railway Electrification

In discussing papers on electrification of railways the question of whether the railroad shall purchase or generate power and problems of speed changes and regenerative control were among the subjects of debate. George N. Eaton, of the Westinghouse Electric & Manufacturing Company, reviewed the thus far fruitless search for some satisfactory speed changing scheme for electric locomotives; he

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Rock Slide Causes Second Collapse of Subway Decking

(Continued from page 429, first column)

Craven, its chief engineer, to call in Mr. Quimby, Edmund S. Davis, chief engineer of the Boston Transit Commission, and D. B. Thayer, past-president of the American Institute of Mining Engineers, to advise on methods for preventing a recurrence of the accidents. Mr. Quimby and Mr. Davis, with Robert Ridgway, engineer of subway construction for the Public Service Commission, visited the scene of the accident at Thirty-eighth Street and Broadway on the morning of Sept. 28.

Steel Set in Open on Seventh Avenue

While the civil authorities and engineers were carrying on a large number of investigations into the accidents and into the work of other subway contractors, the forces of the U. S. Realty & Improvement Company set to work, cleared the wreckage of the Seventh Avenue collapse, placed the concrete bench footings for the permanent columns and set practically all of the 250-ft. section of steel from below Twenty-fourth Street to Twenty-fifth Street in the short space of six days. Trestles to carry the car tracks are being erected on this steelwork, and the street can soon be decked and restored to traffic. This method was adopted as allowing the street to be replaced in a condition safe beyond question, and as being practically as rapid as the erection of any temporary structure. The cableways set up on the day of the accident to clear away the wreckage have been used to advantage in erecting the permanent steel.

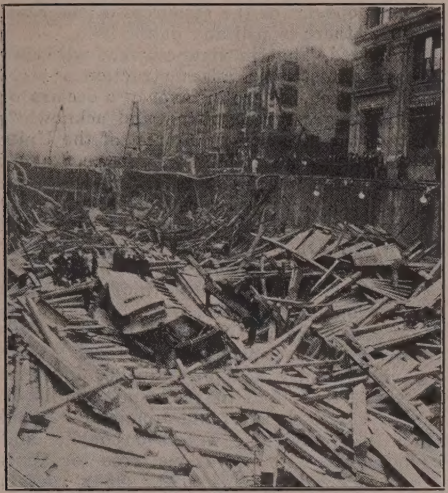
Engineers Approve Shoring in New York Subway Construction

Mayor John Purroy Mitchel of New York City has appointed a committee headed by Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment, to investigate the methods of street support being used in building the new subways in that city. The other engineers who served on the committee are E. P. Goodrich, consulting engineer of the Borough of Manhattan, J. W. F. Bennett, consulting engineer of the Borough of the Bronx, George W. Tillson, consulting engineer of the Borough of Brooklyn, Eugene Stern, chief engineer of the Bureau of Highways, Borough of Manhattan, Merritt H. Smith, chief engineer of the Department of Water Supply, Gas and Electricity, Edwin J. Fort, chief engineer of sewers, Borough of Brooklyn, John R. Healy, chief inspector of the Bureau of Combustibles, Benjamin F. Welton, chief of the Efficiency Bureau, Commissioner of Accounts, Francis W. Ferry, of the engineering force of the Department of Bridges, R. W. Creuzbaur, consulting engineer of New York City, and Amos Schaeffer, consulting engineer of the Borough of the Bronx.

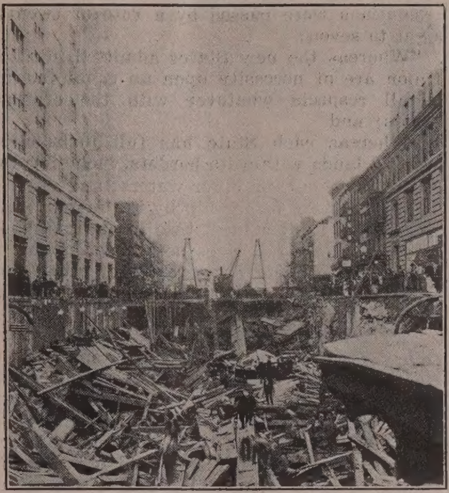
The report of this body, which was not given out until it had been presented to the Public Service Commission on Sept. 28, found fault with the methods being used on five counts, involving only a few localities, all on Broadway between Twenty-sixth and Thirty-first Streets. The recommendations included the substitution of bolts for spikes at a few points in the timbering of the street support, the placing of extra shores against a one-story building, and the placing of additional X-bracing at several points. This report gave a clean bill of health to the great majority of the subway sections now under construction.

After orders had been issued by the civil authorities closing several miles of streets, including two blocks of Broadway where construction had not yet been started, and tying up traffic for the whole day on Sept. 27, a common-sense understanding was reached between the Mayor's office and the Public Service Commission whereby traffic was restored to normal after the recommendations of Mr. Lewis' committee had been complied with.

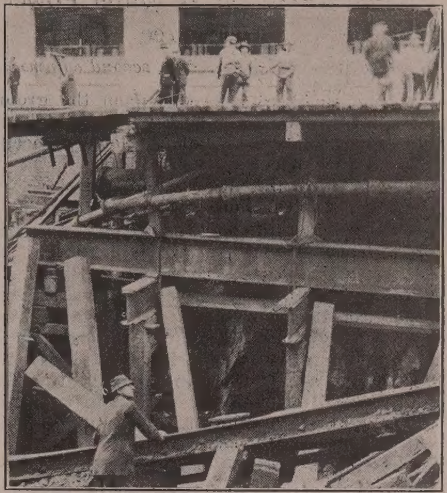
Two Failures of Decking Over New York Subway Cuts in One Week



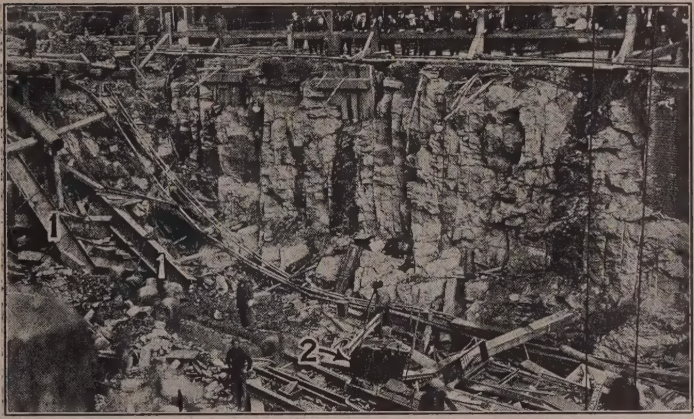
CABLEWAYS, DERRICKS AND CRANE AT WORK



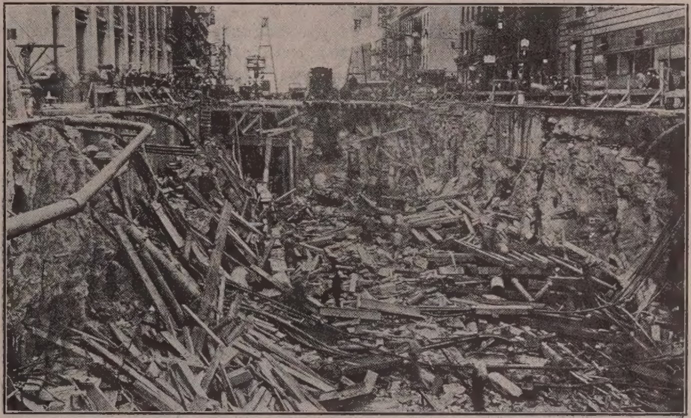
CLEARING SEVENTH AVENUE WRECK BEFORE DARK



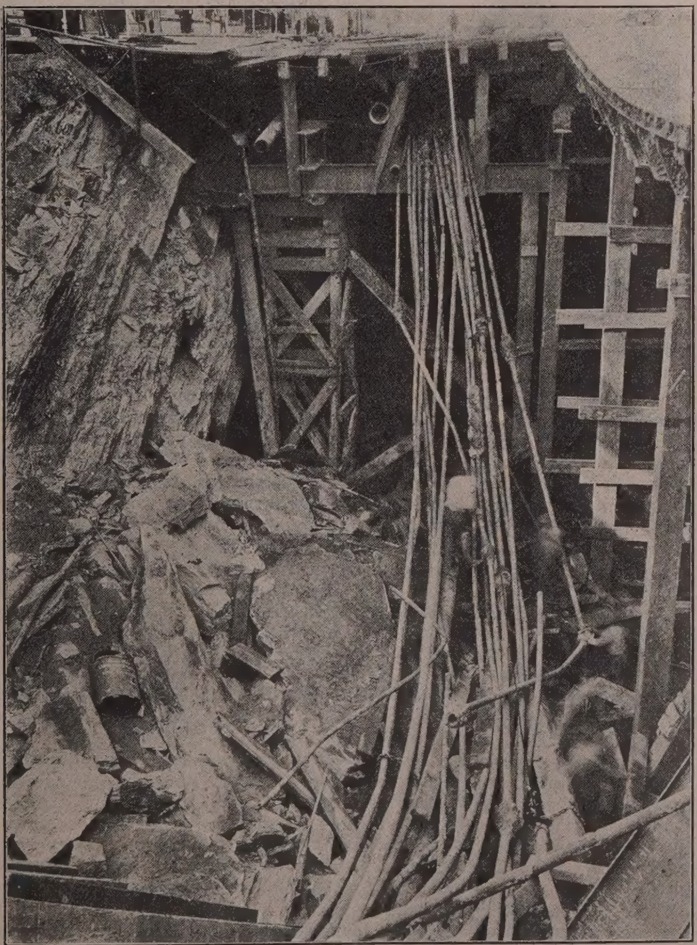
WEST NEEDLEBEAMS, POSTED, STOOD UP



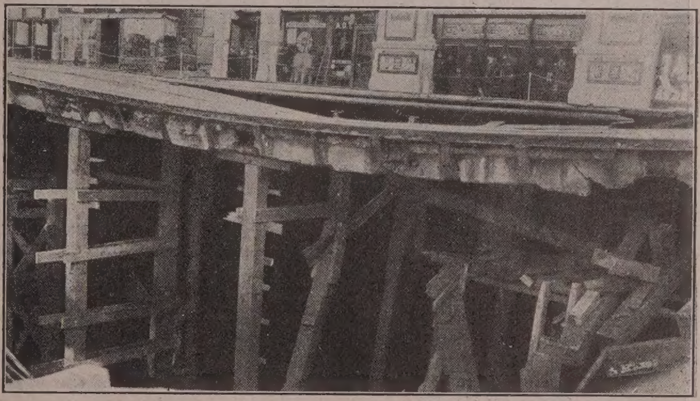
CAR (2) VERY CLOSE TO SOUTH END OF NEEDLEBEAMS (1)



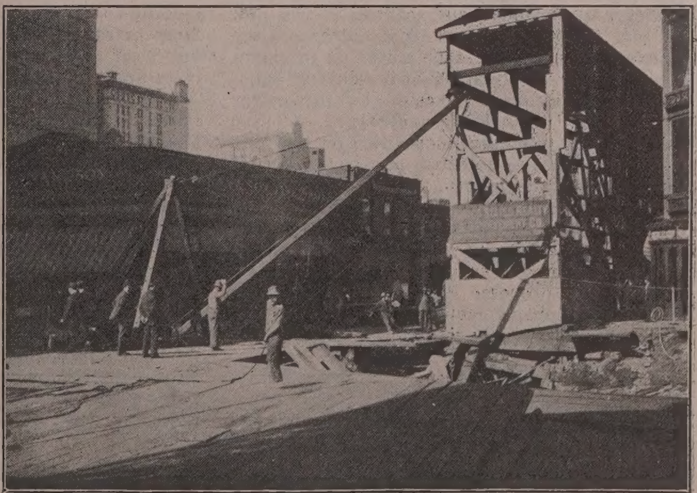
WRECKAGE ON SEVENTH AVENUE ALMOST CLEARED BY NEXT DAY



ROCK SLIDE THAT CAUSED THE COLLAPSE ON BROADWAY SECTION



TRACKS ON BROADWAY SAGGED BUT DID NOT FALL INTO CUT



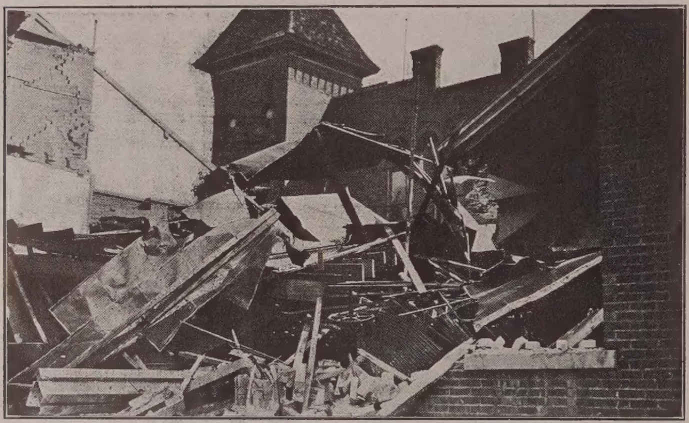
DERRICK SET UP AT BROADWAY AND THIRTY-EIGHTH STREET

Assail Ferris Bill at Water Power Conference

(*Continued from page 429, second column*)

to cancel certificates except upon the ground of non-user or misuser by the holder, and provide for a court review of the act of cancellation by such official.

"The Ferris bill seems to be designed to limit the compensation as nearly as possible to the depreciated value of the physical property, or, as characterized by Justice Lurton in the Omaha water case, the 'bare bones of the plant.' This in most cases would be far from rendering the owner just compensation, and its advocacy is having a baneful influence upon the public utility industries of the country. Those who are endeavoring to have this doctrine prevail as a matter of law in the belief that they are rendering a great public service will, if successful, sooner or later awake to a realization of the fact that men of ability, experience and character who have developed the public-service industries of the country, have made new discoveries and inventions in the arts involved, devised new methods of operation, and, through combination of properties and management, have reduced the cost of service to the benefit of the public, will be either driven out of or voluntarily abandon the field of such industrial activities, allowing it to pass into the hands of a mediocre class, to the great detriment of the public.



LEFT—BATAVIA SEWAGE PUMPING STATION DAMAGED BY EXPLOSION

"Unless the highest order of technical skill and acumen and organizing financial and executive ability can be attracted to and retained in the industry, little advancement can be expected. The present stage of the utility arts is due to the men who have devoted their lives and means to their promotion, not as a philanthropy, but in the hope of reaping financial rewards commensurate with the energy and ability exerted."

On the floor of the conference Senator Thomas J. Walsh of Montana was the recognized spokesman of the administration, and he strongly assailed the position of the power companies and the opponents of the Ferris bill. Senator Reed Smoot of Utah attacked the Ferris bill, contending that it was an infringement of State rights and that it would be legislation on matters that could be far better handled by the States concerned. There seemed to be a general disposition on the part of the delegates to object to any governmental taxation of water-powers that would result in these being turned into revenue-producing enterprises at the expense of the Western States.

S. Z. Mitchell, president of the Electric Bond & Share Company, spoke at considerable length against the proposed legislation, contending that it was impracticable and that it would be impossible to finance water-power development under its provisions. Frank H. Short of Fresno, Cal., spoke strongly against the Ferris bill.

The last day of the conference was marked by heated debate between Senators Walsh and Smoot and Clyde C. Dawson, a delegate from Denver. Senator Clarence D. Clark also assailed the Ferris bill in the closing hours of the conference.

As a result of the conference the following resolutions were passed by a vote of twenty-eight to seven:

"Whereas the new States admitted into the Union are of necessity upon an equal footing in all respects whatever with the original States; and

"Whereas each State has full jurisdiction over all lands within its borders, including the beds of streams and other waters; and

"Whereas the ownership by the federal government of the technical title to vacant public land within a State does not confer upon the federal government any greater or other governmental powers than it possesses within the original States; and

"Whereas the long-established and sound policy of the United States with respect to the disposition of its unappropriated public lands is opposed to the making of a direct revenue therefrom, beyond the expense incident to the surveying, classification and disposing of such lands, but, on the contrary, said policy is intended to encourage and promote the settlement and development thereof, and any act of Congress or any administrative interpretation thereof which is not in harmony with this policy does an injustice to the new States by placing them on an unequal footing with the original States, and by discouraging and preventing the settlement of such new States and the development of their resources; and

"Whereas the vacant land belonging to the federal government constitutes two-thirds of the area of the States represented in this conference and amounts to more than twice the area of the thirteen original States; and

"Whereas the vacant lands belonging to the federal government are under the law exempt from taxation, while the burden of maintaining local government over their entire area rests upon the States; and

"Whereas the maintenance inviolate of the constitutional equality of the States of the Union is essential to that balance of power on which the perfection and endurance of our political fabric depend, and to the harmonious operation of the scheme upon which the Republic was organized; now, therefore, be it

"Resolved, That we are unalterably opposed to any legislation which is in conflict with the fundamental principles above declared.

"Resolved, That the States have the constitutional right and power to control and regulate the appropriation and use of the waters within their boundaries for all beneficial purposes except navigation, and also the right and power to control and regulate the rates and service of their public utilities.

"Resolved, That we are opposed to any policy that looks toward imposing the system of leasing generally upon the public domain, for the reason that such system is contrary to the spirit of our free institutions and would retard the development of the resources of the States in which there is still any public land.

"Resolved, That in view of what we believe to be administrative misconstruction of existing legislation, we are in favor of a declaratory act by Congress recognizing and acknowledging that the proprietary interest of the United States in the vacant land within the States is subject to the jurisdiction and eminent domain of those States for all uses which are declared by the laws of those States to be public uses and which are essential to the development, well-being and prosperity of those States.

"Resolved, That the purposes of encouraging the development and utilization of the natural resources of the country by private enterprise which actuated Congress in the enactment of the right-of-way acts of July 26, 1866, and March 3, 1891, and in the enactment of the acts of March 3, 1877, and June 4, 1897, making all non-navigable waters on public lands, including forest reservations, free for appropriation for beneficial uses, should actuate Congress to-day in the enactment of any further legislation upon those subjects.

"Resolved, That any legislation by Congress the purpose or effect of which is to substitute arbitrary or discretionary authority of executive officials for the fixed rules of law governing the administration, sale or other disposition of public lands and reservation and rights-of-way over the same will be unwise and inconsistent with the spirit of our Constitution.

"Resolved, That we are opposed to ownership or control either direct or indirect by the United States Government of intrastate public utilities."

Still in Doubt as to Cause of Batavia Pumping Station Explosion

Beyond the theory that the explosion at the Batavia sewage pumping station, which was noted in these columns last week, might have been caused by gas escaping from a jet that had gone out beneath the second floor, no conclusion has been reached as to the cause of the disaster. Chester & Fleming, consulting engineers of Pittsburgh, who have been retained to take charge of the works, have made recommendations as to temporary expedients to take care of the sewage. It is planned to pump it from a manhole adjacent to the building until the pump at the sewer well can be placed in operation again. Later a new pumping plant building will be erected.

RIGHT—ENTIRE WEST SECTION CONSIDERED UNSAFE AFTER EXPLOSION

Missouri, Kansas & Texas Goes Into Receivership

A receiver was named Sept. 27 for the Missouri, Kansas & Texas Railway and the Missouri, Kansas & Texas Railway of Texas, the two roads constituting what is commonly known as the "Katy" system. The receivership was due to inability to meet 5-per cent notes for $950,000, the holders of which refused a year's extension at 6 per cent. The system embraces about 3000 miles, and is the third large Middle West line to go into receivership this year.

Concluding Sessions of International Engineering Congress

(*Continued from page* 430, *second column*)

spoke of the impracticability of various gear systems that have been tried. The mercury vapor rectifier experiments on the New Haven had been completed and the equipment was again in the laboratory. This, he said, might prove to be an important development, but it is yet too early, he thought, to predict the outcome, as was also the case with the split-phase scheme tried on the Norfolk & Western. Electric locomotives deteriorate even more rapidly than steam locomotives when not regularly attended, Mr. Eaton said, and allowance for inspection and overhauls should not be slighted in preliminary estimates.

The degree of adhesion to the rail on the same electric locomotive varied, he had found, over 100 per cent under different conditions, and it was unsafe to depend much on the greater adhesion of electric locomotives. Steam engineers learned to handle electric locomotives without difficulty, he found, and were usually eager to change. As to the source of power, Mr. Eaton pointed out the undesirable nature of electrified railroad load when the power systems carried no other, and therefore recommended the purchase of power under contract.

In reply to this A. H. Babcock, consulting electrical engineer, of the Southern Pacific Railroad, said that the load factor for operating trains on mountain divisions would be such that power companies could not handle it, nor could the train schedules be adjusted to make it more favorable, because of the fixed time for moving crops and the congestion on the line in emergencies. On the subject of regeneration, Mr. Babcock said that the value of power thus obtained was negligible as compared to the effective means of braking thus afforded. The advantages are in the elimination of troubles resulting from overheated brake shoes and other brake derangements that often lead to derailments. The great percentage of such troubles that occur with ordinary brake systems near the foot of grades emphasize the desirability of regenerative control.

Condemns Pavement Cuts

In commenting on brick pavements, A. H. Dimock, city engineer of Seattle, said that experience in that city indicated that repressing does nothing but injure brick; wire-cut brick provided with lugs and one beveled edge are preferred. He expressed a wish that some new compound for use as filler for brick pavement could be developed. There is need, he said, for a filler that will not require as much time for setting as does Portland cement, but which will support the edges of the brick better than bituminous compounds.

The evils of frequently tearing up pavements to lay conduits were reviewed by M. M. O'Shaughnessy, city engineer of San Francisco, who pointed out the great necessity for laws under which public service corporations could be made to conform to reasonable rules. It was pointed out that in a half mile on Broadway, New York, a public utility company in six months made seventy-five holes in a pavement for locating leaks and later could not be compelled to overhaul the worn out gas system prior to placing a new pavement. The gas company had found it more economical to remedy trouble after it occurred. Mr. O'Shaughnessy stated that in California a contractor cannot legally be compelled to maintain a contract job in repair after the work has been finished and accepted. The suggested remedy of using sub-sidewalk space for conduits usually laid in streets could not be applied in some cities, it was pointed out, because sub-sidewalk space has been appropriated by property owners. When space is so used, property owners should be obliged to pay the city rental, and it was suggested that it would be very desirable to reserve such space for conduit use where feasible.

Henry Welles Durham, formerly chief engineer, Bureau of Highways, Borough of Manhattan, New York, recommended the adoption of definite limits for subsurface as well as surface construction. He pointed out that Western cities could profit by the experience of New York, which did not adopt such a policy early enough, and the practice in Europe which has long been strict in this regard. In discussing the width of streets, it was pointed out that the distance between curbs should be just sufficient to allow a definite number of streams of traffic. For example, the widening of the roadway of any street would be economical only if an additional line of traffic could thereby be accommodated. In Seattle, the standard roadway in downtown streets is 54 ft., which allows six lines of traffic at 9 ft. each. If this width is increased, it is desirable to make the roadway 72 ft. wide, accommodating eight lines of traffic. Eighteen feet is the standard Seattle allowance for a double-track car line with the standard spacing of 10 ft. on centers. The San Francisco municipal track spacing is 11 ft.

Lapwelded Pipe Has Advantages

In the mechanical engineering session devoted to waterwheels, it was suggested that the fields of civil, mechanical and electrical engineers overlap in hydroelectric power plant design and construction to such an extent that a committee representative of these branches of engineering could formulate rules of much value. W. A. Doble, in comparing the merits of lapwelded and riveted pipes, pointed out that the lapwelded pipe, by its smoother interior, reduces friction enough to permit the use of a smaller diameter pipe; the wear is also lessened, so that a thinner pipe will give the same factor of safety. The lapwelded pipe can be laid in the trench more quickly, and, due to the method of construction, which permits of brush treatment and the application of protective coating while the metal is still hot, the rust and scale objections are eliminated.

Impulse and Reaction Wheels

In the discussion on impulse wheels it developed that local conditions govern the question of single or multiple-jet design. The latter permits of lighter castings, but the single jet simplifies control. Sustained efficiency of the waterwheel for a period of years, it was pointed out, should be considered as carefully as first cost. In choosing between impulse and reaction wheels, the clarity of the water should be carefully considered. The efficiency of a turbine runner, Mr. Doble said, depends first upon its design and second upon the quality of water. In general, the greatest tendency to cut appears in runners of lower specific speed.

Water Power Policies

Strong criticism of Government policy in water power matters was made at two sessions. In the paper by William Hood, engineer of the Southern Pacific Railroad, it was claimed that National laws are such as to prevent Western railroad companies from considering development of water power to electrify their lines. In the paper by John D. Galloway it was stated that a well-defined policy both State and National of hampering all initiative in hydraulic development is the only obstacle to greater use of hydroelectric power. However, G. H. Marx, professor of mechanical engineering, Stanford University, took exception to this view, and expressed an opinion that legislative effort has been solely to protect the public against monopolistic exploitation.

Exposition Engineers Receive Bronze Plaques

"Engineers' Day" was celebrated in the court of abundance at the Panama-Pacific International Exposition on Sept. 24, when C. C. Moore, president of the exposition, presented nine specially designed plaques to the engineers under whose direction the exposition was constructed. The following received plaques: H. D. H. Connick, director of works; A. H. Markwart, assistant director of works; C. L. Bayley, chief mechanical and electrical engineed; E. E. Carpenter, chief civil engineer; Shirley Baker, construction engineer; H. D. Dewell, chief structural engineer; William Waters, superintendent of construction; W. M. Johnson, engineer of fire protection, and L. F. Lourey, assistant chief mechanical and electrical engineer. Each of the nine plaques is 5 x 7 in. in size, of Florentine model, with a laurel wreath surrounding the engraved inscription: "Presented in recognition of services as one of the engineers of the Panama-Pacific International Exposition by its board of directors on 'Exposition Engineers' Day, Sept. 24, 1915."

Municipal Improvements Society Issues Convention Program

The American Society of Municipal Improvements has issued its program for the annual convention to be held at the New Hotel Miami, Dayton, Ohio, Oct. 12-15. The convention will be opened at 9 a. m., Oct. 12, with addresses by George W. Shroyer, mayor of Dayton, Henry M. Waite, city manager of Dayton and Fred W. Rike, president of Greater Dayton Association. The response will be by Morris R. Sherrerd, chief engineer of the Board of Public Works of Newark, N. J. The papers presented will deal, with waterworks, street cleaning, garbage collection and disposal, paving, flood prevention, wood-block treatment, sewerage and sanitation, stream pollution, street lighting, sidewalks and curbs, the Dayton plan of government, obligations of the State to the city in matters of public works, traffic, park development and maintenance and fire prevention. Among the speakers will be: William A. Howell, president of the society; John T. Fetherston, commissioner of street cleaning, New York City; E. R. Conant, chief engineer, Savannah, Ga.; J. E. Barlow, director of public service, Dayton; Dr. D. Frank Garland, director of public welfare, Dayton; Charles H. Rust, city engineer, Victoria, B. C.; C. F. Davis, chairman, Bureau of Water, Philadelphia; A. F. Macallum, city engineer, Hamilton, Ont.; Robert A. Meeker, State engineer of the Department of Public Roads, New Jersey; E. A. Deeds, chairman of the board of directors of the Miami Conservancy District; R. M. Cooksey, principal assistant engineer, Paving Commission, Baltimore; C. D. Pollock, consulting engineer, New York City; W. H. Taylor, Jr., city engineer, Norfolk, Va.; A. M. Reynolds, chief engineer, Essex County Park Commission, Newark, N. J.; J. W. Howard, consulting engineer, New York City; Hermann Von Schrenk, consulting engineer, St. Louis; E. R. Dutton, assistant engineer, Minneapolis; A. D. Duck, city engineer, Greenville, Tex.; William C. Perkins, chief engineer, inspection department, Dunn Wire-Cut-Lug Brick Company; T. Chalkey Hatton, sewer commissioner, Milwaukee; Prof. Earl B. Phelps, U. S. Public Health Service; Louis L. Tribus, consulting engineer, New York City; Alexander Potter, consulting engineer, New York City, W. W. Crosby, consulting engineer, Baltimore, and Henry M. Waite, city manager, Dayton.

The International Engineering Congress Delegates Visit Exposition

The afternoon of Sept. 22 was left open when the program for the International Engineering Congress was made out in order that the visiting engineers might spend this time at the exposition. On that afternoon the delegates assembled in Machinery Palace and were greeted by exposition officials, who presented a bronze medal commemorative of the occasion to the congress. Prof. W. F. Durand, dean of the department of engineering at Stanford University, representing the congress, accepted the medal.

Personal Notes

H. BLITMAN, formerly inspector on construction work in the East River tunnels, New York City, has been appointed instructor in the department of engineering at the University of Minnesota.

HOWARD E. HYDE, formerly designing and principal assistant engineer of the Havana Sewerage and Drainage Contract and, more recently, with Fay, Spofford and Thorndike, consulting engineers of Boston, engaged upon the project for the sewerage and drainage of the city of Fall River, Mass., has joined the staff of Frank E. Winsor, chief engineer of the proposed new water supply for the city of Providence. Mr. Hyde was graduated from Cornell University in 1900 and a few months later went to Havana, Cuba, as engineer in the department of sewers. He left this work in 1902 to become engineer in charge of the construction of the superstructure of the Lower Miami River Bridge of the Toledo Terminal Railroad Company, at Toledo, Ohio, where he continued until 1903, when he went to the Philippine Islands as assistant engineer in the office of the city engineer. In 1906 he attained the grade of acting city engineer of Manila in full charge of the department of engineering and public works, including the department of streets and bridges. In 1907 he returned to Cuba where, as engineer in charge of studies for the protection of the city of Sagua la Grande from flooding by the Sagua River he prepared plans and estimates for controlling works 6 miles long. On the completion of this work he made studies of the Havana water system, including preparations and plans for an additional 42-in. conduit from the Palatino reservoir to the city, estimated cost of which was $240,000. He became principal assistant engineer on the Havana sewerage work in 1908. His return from Cuba was noted in these columns March 13.

C. E. HENDERSON, formerly assistant city engineer of Port Arthur, Ontario, has been appointed city engineer of St. Augustine, Fla.

FRANKLIN HENSHAW has been appointed street commissioner of the village of Scarsdale, New York. The village is planning to expend a considerable amount of money this fall on the improvement and repair of the streets, and expects by next year to be able to develop a comprehensive system for the care of its 26 miles of improved highways and the development of new roads.

JOHN M. HEFFELFINGER has been appointed assistant resident engineer on the construction of the improved sewage treatment plant at Columbus, Ohio.

L. G. KRULL has been appointed county engineer of Wright County, Iowa, succeeding R. E. Rotzler, resigned. Mr. Krull's headquarters are at Clarion.

R. C. DE FREES, formerly assistant engineer on the forces of the Interurban Railway, Des Moines, Iowa, has been appointed computer for the Interstate Commerce Commission, Division of Valuation, Karpen Building, Chicago.

A. L. DIERSTEIN, formerly instructor in civil engineering at Purdue University, has been appointed instructor in structural engineering at Pennsylvania State College.

A. H. ANDERSON, who was graduated from Massachusetts Institute of Technology in May of the present year, has been appointed junior assistant on the engineering forces of the New York State Public Service Commission, First District.

W. D. PEARCE, formerly assistant engineer for the Northern Pacific Railway at Duluth, has been promoted to the position of supervisor of bridges and buildings on the Yellowstone Division for the same company, with headquarters at Glendive, Mont.

H. S. WILLIAMS, assistant county engineer, of Cass County, Iowa, has been appointed county engineer succeeding J. E. Lowther, resigned.

ROBERT H. KUSS, formerly sales engineer for the Edge Moor Iron Company, has opened a consulting engineer's office at 112 West Adams Street, Chicago. He was engineer with the Chicago smoke department for four years and for two years previous he tested fuels for the U. S. Geological Survey, Technologic Branch. He was graduated from the University of Illinois in 1903 and remained there until 1905 as instructor in mechanical engineering. Mr. Kuss has just completed a series of locomotive coal tests for the Grand Trunk Railway System, Western Division, involving the examination of thirteen Middle West coals under running conditions. His lines are steam generation and utilization including smoke prevention and heat transmission problems.

F. K. BENNET, formerly supervisor for the Minneapolis & St. Louis Railroad at Monmouth, Ill., has been appointed valuation engineer of the same road with headquarters at Minneapolis.

JULIUS E. WILLOUGHBY, formerly assistant chief engineer of the Atlantic Coast Line Railroad, has been appointed chief engineer succeeding Edward B. Pleasants, whose death was noted in this journal, Sept. 4. Mr. Willoughby was graduated from the University of Alabama in 1892 and served as traveling land agent for the Louisville & Nashville Railroad from that date until 1900, when he was appointed principal assistant engineer of construction on new lines in the State of Alabama. In 1901 he was appointed engineer of construction on the Alabama & Florida division of the same road. He left this service in 1902 to become division engineer on the Knoxville, La Follette & Jellico Railroad and, a few months later, was appointed chief engineer, in which capacity he had charge of the construction of 105 miles of road, including eight tunnels from 300 to 3600 ft. long and the terminals at Knoxville, Tenn. In 1905 he returned to the Louisville & Nashville as engineer of construction, where he remained until 1912, when he was appointed chief engineer of the Carribbean Construction Company, which was building a railway system in Haiti. He became assistant chief engineer of the Atlantic Coast Line Railroad in 1913.

JAMES N. GLADDING, formerly city engineer of Albuquerque, N. M., has been appointed city engineer of El Paso, Tex. He was graduated from Massachusetts Institute of Technology in 1906 After spending a few months as draftsman for the American Cableway Company, of Fall River, Mass., he was appointed city engineer of Albuquerque, which office he held continuously up to the present appointment.

FRANK C. CAMPBELL has been appointed assistant chemist at the plant of the Great Western Portland Cement Company of Kansas, at Mildred, Kan.

ROBERT E. HILL, formerly assistant computer in the valuation department of the Chicago & Eastern Illinois Railroad, has established a residence at San Juan, P. R., where he will engage in a land surveying business.

CHARLES E. PRESTON, general contractor, specializing in the building of public schools, of White Plains, N. Y., has recently completed a high school at Flemington, N. J., for which he had the contract and is starting work on a school building at Scarsdale, N. Y.

HENRY A. BURR, formerly connected with the Stone & Webster Engineering Corporation and, previous to that, with the bridge and construction department of the Pennsylvania Steel Company, has accepted a position in the maintenance-of-way department of the Nashville, Chattanooga & St. Johns Railway at Nashville, Tenn.

W. H. HEIBY, construction engineer on the forces of the Department of Public Works of the State of Ohio, has been assigned to take charge of shore improvements at Indian Lake in Logan County.

CHESTER G. GILLESPIE, formerly assistant to the city engineer of Sacramento, Cal., has assumed office as director of the Bureau of Sanitary Engineering of the California State Board of Health, which was created by the State Legislature at its last session to investigate water and sewage problems. Mr. Gillespie was educated at the University of California, being graduated from there in 1907. Following graduation he assisted on filtration investigations and miscellaneous sanitary engineering matters under W. W. De Berard, now Western editor of the Engineering Record, and Prof. Charles Gilman Hyde. In 1912 he served as assistant engineer under Professor Hyde, C. E. Grunsky, Charles D. Marx and John R. Freeman on the San Francisco water supply investigation and, later in the year, was appointed assistant engineer for the California State Board of Health on the Sacramento sewage investigations. Subsequently he was on the staff of George W. Fuller, consulting engineer, of New York City, and Langdon Pearse, of Chicago, engaged principally as resident engineer on the construction of the Evanston, Ill., filtration plant. He was appointed assistant to Frank C. Miller, city engineer of Sacramento, in the early part of the present year.

J. E. MORELAND, formerly resident engineer for the Dickson County Highway Commission, has been appointed resident engineer on highway work in Humphreys County, Tennessee, for G. B. Howard & Company, engineers, of Nashville.

G. L. REINERT has been appointed assistant in engineering on the faculty of Pennsylvania State College, Gettysburgh, Pa.

W. H. BADEAU, formerly connected with the Acme Cement Corporation of Olsen, N. Y., is now engaged with N. R. Porterfield, 17 Battery Place, New York City, on the construction of a 300-ft. Ambursen dam in connection with the waterworks system of Watervliet, N. Y.

I. A. BAUM, city engineer of Texarkana, Ark., and J. W. Haynes have entered into a partnership to practise as consulting engineers, with offices in the State National Bank Building, Texarkana. Mr. Baum, previous to becoming city engineer, was for a number of years in the engineering department of the Chicago, Rock Island & Pacific Railway. Mr. Haynes is a recent graduate of the University of Mississippi.

Civil Service Examinations

United States.—The Civil Service Commission announces that there will be held at the usual places on Wednesday, Oct. 20, examinations for the positions of junior civil, junior structural, junior mechanical, junior signal and junior electrical engineers, grades 1 and 2, salaries from $1,200 to $1,680 and from $720 to $1,080 a year for grades 1 and 2 respectively, and for the position of junior architect, salary $1,200 to $1,680, in connection with the Interstate Commerce Commission. Applicants must be between 21 years and 36 years of age and must have specific training in their respective fields, experience being in work in connection with railroads. The required length of this training and experience is four years for grade 1 and two years for grade 2 engineers and four years for the position of junior architect. These positions are open especially to young men who have recently started in engineering or architectural work. Further information, for which it would be advisable to apply immediately, may be secured from the Civil Service Commission, Washington, D. C., or the civil service boards at the principal cities, from whom form 2039, stating the title of examination, should be requested.